A

POPULAR TREATISE

ON

THE KIDNEY.

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The whole Nucleus and Portions of Nucleus of The Kidney of A. Insect. — B. Reptile. C. Fish. — D. Bird. — E. Beast. and F. Human Subject. — Geo. Corfe on the Kidney.

G. Foggo Delᵗ.

J. Graf. Printer to Her Majesty.

A POPULAR TREATISE

ON

THE KIDNEY:

ITS HITHERTO UNKNOWN FUNCTIONS AND ITS DISEASES,

IN CONNECTION WITH THE

CIRCULATING ANIMAL OILS, &c.

WITH

ADVICE TO PERSONS ON THEIR SECRETIONS.

BY GEORGE CORFE.

LONDON:

BAISLER, 124, OXFORD STREET;

& RENSHAW, 356, STRAND.

MDCCCXXXIX.

[ENTERED AT STATIONERS' HALL.]

TO THE

NOBLEMEN AND GENTLEMEN,

GOVERNORS

OF THE

MIDDLESEX HOSPITAL;

IN TESTIMONY OF THE MANY FAVOURS RECEIVED FROM THEM

DURING THE PRECEDING PERIOD OF EIGHT YEARS,

THIS VOLUME

IS, WITH MUCH RESPECT AND GRATITUDE,

DEDICATED BY THEIR MOST FAITHFUL,

AND OBEDIENT SERVANT,

GEORGE CORFE.

Middlesex Hospital,
March 1839.

PREFACE.

THE following pages were compiled during the writer's spare moments from the professional labours of his office throughout a space of three years. In the production of them, he has been kindly assisted by one dear and most valued Christian friend, whom the LORD has, in His goodness, bestowed on him as a fellow pilgrim in the road to the Heavenly Zion, and whom He has endowed with a rich store of heavenly light and wisdom. To this friend he owes, as an instrument in the hand of that GOD in whom we live and have our being, much of the original matter, and very many of the new perceptions which are put forth in the work. With this exception, the volume is the product of his own researches, and of the experience of his professional labours.

Established as the writer is, in a public office, in which it is his bounden duty to devote all the time and exertion of mind which every branch of his department so justly lay claim to, he would never have set apart the small portion taken from periods for relaxation, to bestow on any undertaking in which the glory of GOD, and the benefit of his fellow-creature, were not involved. On these two principles, therefore, he sends forth the work; and if his object be in some measure attained, although it be at the risk of incurring the disapprobation of some few individuals who

may not kindly, or candidly, appreciate his motives, yet exercising himself to have always a conscience void of offence toward God, and toward men, his satisfaction will be great, and his desire obtained.

A considerable part of his life has been cheerfully passed amidst the suffering poor of the infirmary, or the hospital, of Salisbury, St. Bartholomew, and Middlesex, during thirteen years; and as his opportunities for observation have not been few, neither is his anxiety little, to communicate any results which may be likely to prove of general utility to members of the profession, or a benefit to the public at large.

Middlesex Hospital; March, 1839.

DESCRIPTION OF THE FRONTISPIECE [1].

A. The stomach and intestinal canal of a Locust; the lines being its ducts; the upper pair its biliary, and the lower pair its urinary ducts.

B. The stomach, intestinal canal, and heart of a Scorpion. The grape-like bunches represent the isolated lobes of the liver, and the lines issuing therefrom, the bile ducts, passing into the stomach. The lower lines represent the urinary ducts coming off from a vascular net-work spread over the abdominal fat. The central tube is the heart [2].

C. The nucleus or matrix of the Kidney of a Cod Fish, as seen, like a large pink or camomile flower, towards the top of the figure.

D. The nucleus or matrix of the Kidney of a Goose; its two renal veins of secretion are cut off, displaying the whole series of its feathery oil-tubes.

D 2. A few feathery oil-tubes springing out from a branch of the nucleus of a Fowl's Kidney.

E. The entire Kidney of a Rabbit, with its surrounding log of oil.

E 2. The nucleus or matrix of the Kidney of a Rabbit, with its adjacent fat, and its reflected membrane.

E 3. The nucleus of the Kidney of the same brute, divested of its surrounding fat and reflected membrane.

E 4. A bunch of feathery oil-tubes from the nucleus of a Sheep's Kidney.

E 5. Section of a nucleus of a Sheep's Kidney.

E 6. A perfect specimen of the nucleus or matrix of the Kidney of a Sheep.

E 7. Moiety of a Sheep's Kidney. A bristle passes through the urinary duct. A renal plexus of nerves is seen to lie over the vein and artery. The seven semicircular oil-tubes are displayed. The fat may be observed to surround the vessels, but not the duct.

E 8. A bunch of feathery oil-tubes and urinary ducts, as they are joined in nature; the light ones are the tubes, the darker portions the ducts.

[1] The series of natural preparations, of which these drawings, by that eminent historical painter, George Foggo, Esq., are beautifully illustrative, are presented to the Middlesex Hospital, for the use of the Medical School attached to that institution.

[2] These two figures are copied from Müller's work; "De penitiori structura glandularum." Leipsic, 1836.

E 9. The reticulations of the semicircular oil-tubes of a portion of the nucleus of an Ox's Kidney. Five bristles are passed into their respective veins as these vessels traverse the semicircular oil-tubes.

E 10. A single feathery oil-tube from the nucleus of an Ox's Kidney, magnified twenty-five times. The nodules at the joints exhibit the globules of oil circulating within it.

E 11. An entire bunch of urinary ducts of the Sheep's Kidney in their whole course from the surface to the papilla.

E 12. A feathery oil-tube from the nucleus of the Kidney of an Ox, magnified six times.

E 13. Another view of a perfect nucleus or matrix of the Kidney of a Sheep, with its reflected membrane attached thereto.

E 14. Interior view of the same nucleus.

F. A perfect nucleus or matrix of the Kidney of the human subject, with a portion of its reflected membrane turned down to expose the fat which passes inwards towards the seven semicircular oil-tubes.

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A

POPULAR TREATISE

ON THE

KIDNEY; ITS OILS, &c.

PART I.

CHAPTER I.

DIVINE ACCEPTANCE THEREOF.

The organs which form the subject of the present treatise, have been regarded by physicians, in all ages, as intimately bound up with the health or derangement of the animal economy.

Influenced, as they are, by every change that the body is subject to, in its ailments and diseases, whether from external or internal action, they have occupied the attention of medical writers, from the infant state of medicine to the present hour.

I hesitate not to affirm, that no branch of medical science has been the subject of such a variety of compilations and treatises as that of the renal organs and their appendages; yet are we living in the nineteenth century without any accurate and complete work upon the anatomy, physiology, and pathology of the Kidneys.

Before I proceed to give an outline of the various opinions which ancient and modern authors have advanced concerning the uses, powers, and diseases of these organs, I must lay before my readers the earliest notices of them, by Revelation. In the prosecution of this part of my subject, we have the infallible, unerring word of God, preserved to us through time, for our guidance, and instruction. The Kidneys and their fat, were commanded by the

Lord God Almighty, to be offered up as burnt sacrifices under the legal or Mosaic dispensation, by His chosen people, the Jews.

This is the earliest history that we have of sacrifices of particular animals, and particular parts of those animals, to God. That the heathen ideas of sacrifices, of which we read in numerous authors subsequent to Moses and Aaron, were originally grounded on the primitive offerings of Cain and Abel[1], and even on Adam's vesture from a slaughtered beast, no one will doubt who attentively peruses the ancient records of the eastern nations.

Indeed, it is the opinion of many persons, that as soon as our first parents fell, and incurred God's wrath and displeasure, that the very beasts, whose skins covered their bodies, were, for the first time, offered as typical sacrifices to an offended God and Creator. These types were carried down from generation to generation; and whilst all the offspring of Adam's scattered race preserved the substance of the sacrifice, viz., an animal one, yet they lost the particular character of beasts commanded to be offered; and we find from Virgil, Ovid, Homer, and Herodotus, &c., that cows, and other quadrupeds, were used to propitiate their offended deities[2].

Notwithstanding the lapse of nearly six thousand years, we still find the sacrificial offering amongst the heathen; and in an Indian Missionary Journal of 1836, there is an account of the sacrifice of 1000 sheep to a goddess, who was supposed to be highly displeased with the inhabitants of a town, and had sent the plague amongst them, by which many hundreds were carried off.

But the particular sacrifices and daily oblations which God had commanded His servant Moses to direct that the Jews should offer, were continued throughout the whole Jewish dispensation, until the coming of our Lord Jesus Christ, who was to put away Sin by the sacrifice of Himself upon the accursed tree; and by His one offering to bring in an everlasting righteousness, which should be unto all, and upon all them that believe on His name. "And this man, after He had offered one sacrifice for sins, for ever sat down on the right hand of God." Heb. x. 12.

[1] Of these two offerings, Cain's was rejected, because it was an offering of Works; the produce of his own cultivation. Abel's, being a typical sacrifice on the doctrine of substitution, of propitiation by Blood, the blood of the Lamb of God, was accepted.

[2] Clemens of Alexandria remarks, that, "the mysteries of the Greeks begin with expiation, as those of the barbarians with ablutions;" and Tertullian says, "that in the Eleusinian mysteries, they perform ablution, in order to obtain regeneration, and impunity for their perjuries."

In comparing the various passages of Holy Scripture, where mention is made of the sacrifice of the KIDNEYS and fat, &c., we find the following beasts, only, were commanded to be used:—the bullock, the heifer, the goat, the kid, the ram, the sheep, and the lamb.

The sacrifices and ceremonies for consecrating the priest for the LORD's service, were as follows:—

"And thou shalt take all the fat that covereth the inwards (bullock) and the caul, (it seems by anatomy and the Hebrew doctors to be the midriff), that is above the liver, and the two KIDNEYS, and the fat that is upon them, and burn them upon the altar." Exod. xxix.

"Also thou shalt take of the ram, the fat and the rump, and the fat that covereth the inwards, and the caul above the liver, and the two KIDNEYS, and the fat that is upon them, and the right shoulder, for it is a ram of consecration." Exod. xxix.

These were to be burnt upon the brazen altar, as the same parts of the bullock.

The priests, being thus consecrated, were directed to offer up the sacrifices for the people, after a particular manner.

The sacrifice and ceremonies for offering the peace-offering by the priest, are thus:—

"And he shall offer of the sacrifice of the peace-offering, an offering made by fire unto the LORD (a lamb or goat), the fat (or suet) that covereth the inwards, and all the fat that is upon the inwards; and the two KIDNEYS, and the fat that is on them, which is by the flanks, and the caul above the liver, with the KIDNEYS, it shall he take away." Levit. iii.

The priests were to burn this offering upon the brazen altar, the same as the other offerings.

"And he shall offer of the sacrifice of the peace-offering, an offering made by fire unto the LORD, the fat thereof, and the whole rump, it shall he take off hard by the back bone, and the fat that covereth the inwards, and all the fat that is upon the inwards," Levit. iii. Then follow the same words as above, and they are again repeated in the 14th and 15th verses, whether it be a lamb or a goat.

The sacrifice and ceremonies for offering a sin-offering of ignorance, whether committed by the priest, or the people, were thus:—

"And he (the priest), shall take off from it (the bullock), all the fat of the bullock for the sin-offering, the fat that covereth the inwards, and the two KIDNEYS," &c., Levit. iv. Here follow

the same words as in Levit. iii. "As it was taken off from the bullock of the sacrifice of the peace-offerings;" and "the priest shall burn them upon the altar of the burnt offering."

The sacrifice and ceremonies for offering, as Moses offered, when he consecrated Aaron and his sons, run thus:

The sin-offering was a bullock.

"And he slew it, and Moses took the blood, and put it upon the horns of the altar round about with his finger, and purified the altar, and poured the blood at the bottom of the altar, and sanctified it, to make reconciliation upon it; and he took all the fat that was upon the inwards, and the caul above the liver, and the two KIDNEYS, and their fat, and Moses burned it upon the altar."

The peace-offering was a ram of consecration. "And he took the fat, and the rump, and all the fat that was upon the inwards, and the caul above the liver, and the two KIDNEYS, and their fat, and the right shoulder." Levit. viii.

Aaron's offering of the sin-offering, burnt-offering, and peace-offering, for himself and the people, was thus:—

A calf for the sin-offering for himself; but a kid of the goats for a sin-offering for the people. "But the fat and the KIDNEYS, and the caul above the liver of the sin-offering, he burnt upon the altar; as the LORD commanded Moses."

A ram for a burnt-offering for himself. A calf, and a lamb as a burnt-offering for the people. "And he brought the burnt-offering, and offered it according to the manner" (or ordinance); that is, as before.

But a bullock and a ram were both for himself and the people, in the peace-offering.

"And the fat of the bullock and of the ram, the rump, and that which covereth the inwards, and the KIDNEYS, and the caul above the liver; and they put the fat upon the breasts, and he burnt the fat upon the altar."

"He slew also the bullock, and the ram for a sacrifice of peace-offerings, which was for the people." Levit. ix.

The foregoing extracts contain all the passages wherein the HOLY GHOST speaks of the KIDNEYS, &c. We may observe, too, that when Moses sanctifies Aaron (and the priests afterwards by Aaron), he offers a sin-offering (a bullock), then a burnt-offering (a ram), and then a "ram of consecration;" which, when offered by the high priest, for the people, is called a "peace-offering." This "ram of consecration," whether

offered by Moses, or the succeeding high priests, for sanctifying the sons of Aaron, was "The Peace-offering;" and in this offering the Holy Ghost commands another part also to be taken, in addition. J. Allen thus remarks on the sacrifices: "The priest puts the fat upon the hands of the offerer; on the fat he lays the breast and shoulder; next he places the two Kidneys, and the caul of the liver. The burnt-offerings of the whole congregation, when they were properly cut up, and the accompanying drink and meat offerings, used to be carried to the sloping ascent of the altar, and there sprinkled with salt. Nine priests performed this duty on all ordinary occasions, in the following manner: the first carried the head, the hinder foot, and the fat; the second, the two fore feet; the third, the back bone, the caul, and both Kidneys; the fourth, the neck and breast; the fifth, the two loins; the sixth, the entrails, placed on a dish, with the legs laid upon them; the seventh, the meat-offering appointed to accompany the burnt-offering; the eighth, the high priest's meat-offering; and the ninth, the wine for the appointed drink-offering.

Grotius, adopting the opinion of the Rabbies, represents the mystical sense of this ceremony to be, that the honour of God requires the mortification of the sensual appetites, the instruments of which are the fat, the Kidneys, &c. It must also be observed, that the kind of fat, or that which is commonly called tallow, which was to be burnt upon the altar, was among the unclean parts which the Jews were forbidden to eat; but they were allowed to eat all the rest of the fat. The two kinds of fat are distinguished by Rabbi Bechai; "one as being separate from the flesh, and not covered by it, as by a rind; the other as not separate from the flesh, but intermingled with it. The separate fat is cold and moist, and has something thick and gross, which is ill digested in the stomach; but the fat which is united with the flesh is warm and moist." The latter (שמן) every one was at liberty to eat; but any person who should eat the former (חלב) was to be cut off from among the people.

It may be interesting to my readers to have the opinion of two celebrated Rabbies upon the peculiar ordinance which the priest had to submit to, in receiving from the high priest the blood of the "ram of consecration" upon his "right ear," "right thumb," and "right toe:" they were intended to teach the priest that he should apply himself with diligence to the study of the sacred law; that his hands should be sedulously employed in the sacred

ministry; and that he was to walk in the ways and commandments of God. The right, denoting perfection [1].

Before I conclude the subject of the types and ordinances under the Levitical priesthood, as far as they refer in particular to the KIDNEYS, fat, &c., it may be as well to notice the qualities of the sacrificed beasts. It was an absolute command that the creatures offered, should be clean, that is to say, fit to be eaten for the support of human life; and so, by their aptitude for digestion and nourishment, become associated with the substance of man's body; and thus, in some sense, to be one with the offerer. This was an evident memorial of the sanctity of the Great Propitiation, and that He should be partaker of the same flesh and blood with those for whom He should die; for it was requisite that both He that sanctifieth, and they that are sanctified, be all of one. They were to be healthy, perfect, valuable, and, in a sense, beloved creatures. Not the stupid ass, or the dirty swine, though they might be tame creatures; neither the fierce beasts of the forest were suffered to come upon God's altars: but He delighted in the gentle dove, the patient and laborious ox, the meek lamb, and the sheep that is dumb before her shearer and slaughterer. Who is he that sees not in these characters the very picture of the meek, holy, patient, and undefiled One, Christ Jesus, the Saviour of His people, who opened not His mouth when He was led as a Lamb to the slaughter? But the legal sacrifices were more or less expensive to all that presented them; the real and better Sacrifice, however, costs us nothing; for we may buy it without money and without price: for thus saith the LORD: "Ho, every one that thirsteth, come ye to the waters, and he that hath no money; come ye, buy, and eat; yea, come, buy wine and milk, without money and without price." Isaiah lv.

[1] Abarbinel, and Rabbi Levi Ben Gerson.

CHAPTER II.

ANCIENT AND MODERN WRITERS ON THE KIDNEY.

It is said that the physicians of the Chinese empire consider their celebrated writer, Hoangti, the founder of medicine amongst them. In the medical code of this curious person are found many of those hypotheses which are now current amongst their modern writers. They consider vital heat, and radical moisture, the two natural principles of life. The seat of the former is referred to the intestines; that of the latter resides in the heart, lungs, liver, and Kidneys. Upon what grounds this singular people base such theories, it is impossible to say, with our limited knowledge of their medical literature. But how far there is plausibility in the system will be seen in the succeeding pages of this work [1].

The opinions of medical writers, throughout all ages, upon the offices of the Kidneys, seem to be, generally, that they secreted fluid from the blood. But before the period when the true circulation of the blood was revealed to the mind of our countryman, Harvey, the secretion from these glands was looked upon by some anatomists as venous; by others, as arterial; and a few considered that both characters of blood entered into the component parts. Although modern writers have selected a few scattered fragments from some authors who wrote in the early ages of Polytheism, previous to the Christian era, and by these authorities would seem to throw out a hint that the ancients were not altogether ignorant of the circulation of the blood; yet the notion, if it ever really existed amongst them, was not pursued as its importance merited; otherwise, many extraordinary facts would certainly have spruug out from its ready entrance in the minds of men. A passage to the above effect is quoted by many. "They (the gods) established the heart, which is both the foun-

[1] Abbé Grozier's China, 1788.

tain of the veins and the blood, which is vehemently impelled through all the members of the body in a *circular progression*[1]." Ancient anatomists have necessarily left us, therefore, a very imperfect description of the KIDNEYS. According to most of them, the theory ran thus: the emulgent vein having carried the blood into the gland, and joined itself with the ureter, the remaining portion of the blood, which did not serve the purpose of secretion, actually contributed to the structure of the organ, which they, consequently, termed "parenchyma," or thickened juice. This indeed gives but a faint notion of the beautiful structure of these parts[2]. Such imperfect anatomical knowledge led to the conclusion, that the KIDNEYS separated serum, or the watery portions of the blood, from veins, as well as from arteries. Hence are they repeatedly termed "elices," or sluices, "sulci aquarii," or "water drains" of the system.

The practical knowledge which that extraordinary man, HIPPOCRATES, acquired, is almost incredible, especially under this branch of pathology. His observations will be more to the point, when the treatment of diseases of the KIDNEYS shall be considered. The remarks, throughout his aphorisms, upon the symptoms of disease in these organs, show, that they were the result of careful investigation, and of sound judgment, at the sick bed.

GALEN proposes four questions, to explain the mode by which secretion takes place in the KIDNEYS. By these, it is evident that he looked upon the veins as the principal channels for carrying fluid for secretion. He says, "1st, Does the secretion flow into the KIDNEYS by its own power of motion? Or, 2ndly, does it fill up a vacuum there? Or, 3rdly, is it propelled by an expulsive power of the veins? Or, 4thly, is it drawn thither (to the KIDNEYS) by an attracting power of the KIDNEYS[3]?"

The labours of modern anatomists have cleared up some of these points, and made others obscure.

CARPI, who wrote in the sixteenth century, noticed, that water injected into the vein of the KIDNEY, returned through its pelvis and ureter; or flowed from the slightest incision previously made on its surface. He concluded, therefore, that a communication existed between the renal vein and all other parts of the organ. He attentively examined the openings by which this injected fluid escaped, and observing the freedom with which it flowed

[1] Plato's Timæus. [2] Bertin's Treatise, 1744. [3] Vide Appendix, No. 1.

from the papillæ into the pelvis, conceived that the ducts of the mammillary portion of the KIDNEY were continuations of the renal vein [1].

Since CARPI's able work, most anatomists knew the distribution of the renal vessels; and yet it is surprising that VESALIUS, who wrote after that celebrated man, was ignorant of their course.

MATHÆUS DE GRADI, who wrote about the time that CARPI flourished, was the first to declare that the vessels ramified freely throughout the vascular portion of the KIDNEY; and he ably exposed the crude notions then received. This substance was considered an assemblage of arteries and veins by DE GRADI, CARPI, FALLOPIUS [2], EUSTACHIUS [3], and DU LAURENS [4], and they have left a very accurate description of them.

The medullary structure was declared by CARPI to be composed of veins carrying urine; FALLOPIUS names them hair-like vessels; EUSTACHIUS, by his plates, gives us the same idea; BELLINI described them with more accuracy in his plates; though MALPIGHI, RUYSCH, and VIEUSSENS have left us the best descriptions we possess of the anatomists of other days.

DEUSINGIUS, in his anatomy of the human body, speaks thus: "The KIDNEYS perform their secretion by an inherent power; they remove the superfluous serum, with its salt and tartar, to the ureters; and having purified the blood [a portion being yet left behind which affords nourishment to the gland], they send this fluid away by the returning veins to the cava; and, at length, to the heart [5]."

It may be noticed here, that the opinion included within brackets above, has never yet been explained by modern authors; viz., how an organ, such as the KIDNEY, should be nourished from a vessel which is said to carry blood charged with a deadly poison, urine.

But the same vague idea pervades the mind of a celebrated writer of the last century; he remarks thus: "The renal artery, after forming its intorsions within the gland, is said to be employed in secreting urine; and the other part of the artery, necessarily, supplies life and heat to the substance of the KIDNEYS, and from the blood conveyed by this part of the artery seems to arise that large quantity of lymph, which returning from the KIDNEYS, and being of the laudable, and not of the excrementitious kind, mixes with the chyle, circulates with the blood,

[1] Vide Appendix, No. 2.
[2] Observationes Anatomicæ.
[3] De Renum Structura.
[4] Livre Sixième.
[5] Vide Appendix, No. 3.

and does not taste like urine. Hence, also, there will arise, without doubt, corresponding veins. These convey, in various manners, the remaining blood to the vena cava[1]."

HARDERUS, in his work, on "The Structure and Use of the Internal Organs," endues the KIDNEY with noble and ignoble properties.

The latter character is given to it, because, by this organ, the useless watery humour, with which the veins and arteries are loaded, is drawn off, as water drains, from the vena cava and aorta.

ARISTOTLE thought, moreover, that the renal fat performed important offices in the action of these glands; and that it was instrumental in the preservation of healthy blood. He considers that it may be regarded as a fact, that whenever there is abundance of suet upon the KIDNEYS, the blood is certainly rich and healthy[2].

But there are yet other authorities among the ancient anatomists who have attributed to the veins of the KIDNEY some share in the secretion of urine. LAUREMBERGIUS, after styling the vessels of the glands "water drains[3]," uses these words: "These veins carry away serum, or any thing else;" and in the same manner that fields are drained of their excess of water by drains, so is the blood of its serous portions by these vessels[4].

VESALIUS, writing upon this subject in his "Anatomy," remarks: "The substance of the KIDNEY is endued with a property peculiar to itself, by which it draws off, through its body, the superfluous serum from the arteries and veins, and carries them away to the pelvis (which is a membranous substance), and thus it is received into the ureter[5]."

HIGHMORE is even more explicit than others; for, after he has described the minute branches into which both sets of vessels pass, and their mode of forming circular spaces, enclosed by one common membrane, he adds: "Empty spaces are seen between these vessels (arteries and veins), from which the serum is drawn off through the substance of the organ into the pelvis; this 'parenchyma,' or substance, fills those empty spaces[6]."

BAUHINUS asserts, that "the use of the KIDNEY is, to draw off the watery blood from arteries and veins, so that the blood may be purified[7]." LAURENTIUS makes the same remark in his anatomical work.

[1] Dr. James's Dictionary. Fol. 1745.
[2] Vide Appendix, No. 4.
[3] "Elices."
[4] Vide Appendix, No. 5.
[5] Vide Appendix, No. 6.
[6] Vide Appendix, No. 7.
[7] Vide Appendix, No. 8.

I now pass on to notice the opinion of the celebrated Bartholinus, who has the same difficulty to combat with as the foregoing authors have; viz., How the renal artery should secrete so deadly a fluid, (I mean by the expression "deadly," deleterious, as when pent up in the circulation, in contradistinction to bile pent up, which is not, in such a position, destructive of life), and yet convey to the bosom of the gland, rich and nourishing blood? He says, "But part of the blood remains (and the most healthy part too) for the nourishment of the Kidneys, whilst another part passes into the open venous mouths, and goes back by the cava to the heart [1]."

It is most assuredly a contradiction of terms to call an artery a nutrient vessel, whilst it possesses a fluid charged with a deadly poison; for such the renal artery must be, if it answers both purposes. But it may be advanced, that the remark applies to all other glands, similarly supplied with blood. In reply, I would observe, that there is no other gland in the animal body which sends forth a deadly, and, therefore, wholly excrementitious fluid, like unto the secretion of the Kidneys. When I have occasion to refer to the subject of secretion, hereafter, I hope to show, most satisfactorily, that all fluids poured out from glands, originate conjointly in venous blood, and adipose matter; fat, or oil.

It forms a most singular feature in the medical history of the anatomy and physiology of these glands, that although writers have constantly asserted that the blood was prepared, or digested, and in some way made more fit for circulation within their bodies, that, nevertheless, none appears to have followed up the proposition, by suggesting any mode by which such a process was performed, or such a purification accomplished.

The principle seems for the most part to have originated in the minds of our reflecting forefathers, from witnessing the mass of fat in which the Kidneys were seen to be imbedded. Fat, they well knew, was a preserver of animal heat; hence, they concluded, that the fattest organs were necessarily the warmest parts of the body. Fat, moreover, they found essential to animal life; and that it was even the entire sustenance of hyemal animals; as of the dormouse tribe, &c. &c.

Aristotle has referred us, as an instance of this fact, to the state of bears, previous to the winter's drought setting in; when,

[1] Vide Appendix, No. 9.

as he says, they became extremely fat, even with a scanty supply of food[1]. Another writer affirms, that, "mice living upon the tops of mountains, become very fat towards, and in winter, even without food[2]."

I am not surprised, therefore, at finding such stress laid upon the importance of the renal fat; and when my readers see the account of the various experiments made upon this matter, in the human subject, and in animals just slain, they will readily draw the same conclusion.

I can unhesitatingly bend to the opinion of an author already quoted, who endues the KIDNEY with eight honourable properties; and amongst them is this curious and remarkable one:—

"That the more noble office of the KIDNEY is to prepare the arterial and venous blood:" and then, he asks, "what can the mass of fat around the KIDNEYS be destined for, but that it may prepare, and digest (concoct) the blood[3]?" So that it afterwards appears, in his sensible remarks upon the offices of the KIDNEYS, that he considers the circumjacent fat, an essential principle in the natural action of the organs, by which a due degree of heat is constantly preserved, to enable them to pour out the copious acrid fluid, and salt from the blood.

VAN DER LINDEN observes, that "the renal fat is to lubricate the organ; prevent attrition on the muscles of the loins; and to preserve the KIDNEY from too great heat, the foundation of tedious diseases[4]."

But this idea was never more fully carried out than by Malpighi. This celebrated man devoted much labour and attention to the subject. In his works, he has thrown together such a mass of valuable facts, that their very novelty appears to have paralyzed the efforts of succeeding writers; and he has left them nothing to do, but to endeavour to refute his principal theories.

The subject received much attention, from the celebrated JOHN HUNTER, who desired his friend, Mr. Jenner, to examine hedgehogs at the approach and termination of winter; from which it appears, that the consumption of fat, in these hyemal animals, commences at the supra renal mass; then the mesenteric and omental, and lastly, the layers immediately beneath the skin. All of them were found enormously fat at the approach of winter,

[1] Comparative Anatomy.
[2] Ray's Wisdom of God.
[3] Vide Appendix, No. 10.
[4] Mirabilis Structura Renum.

and scarcely a vestige of fat was seen about them at the termination of this season [1].

That eminent physiologist hastily concluded, therefore, that fat was chiefly employed in the animal economy for the preservation of heat; and that it acted as a great coat, or blanket to the creature. I shall notice this subject hereafter; but would just observe, that although in one point he was correct, that Hunter misunderstood the grand feature and beauty of these experiments; and hence was in darkness upon the subject.

Various conjectures were formed by ancient writers upon the uses of the renal fat; and the reasons assigned for its deposition there, more than in other parts of the body, are so numerous, that it would be tedious, and indeed, useless, to quote them; they have, however, left the matter undecided; and modern physiologists have done no better; for they have either wholly neglected the subject, or have passed it over in a very summary manner. However, those three eminent men, Malpighi, Morgagni, and Hunter, have left us a valuable series of facts, from experiments, &c., that I must again avail myself of their researches, and resume the consideration of them when the subject of "The Oils," is taken up; meantime, I beg leave, at once, to pass on to the view of the anatomy of the organ as it is handed down to us, by the first of the above men.

[1] Catalogue of Hunt. Mus. R. C. S.

CHAPTER III.

ANCIENT AND MODERN WRITERS ON THE KIDNEY.

It is well known, that Malpighi was the writer who fully made out, and accurately described, the little bodies, "pomula," or "crypta," that hang like bunches of currants from the renal

artery. He thought they were glands; and that from them originated the urinary ducts. After describing the KIDNEY as a fibrous body composed of innumerable vessels and ducts, he proceeds thus:—

"But, in order that these points may be better known, a black colour mixed up with spirits of wine, must be injected into the emulgent artery, until the whole KIDNEY swells, and becomes dark on its exterior; then, with the naked eye, when the membrane is removed from them, may be seen the bifurcations of the artery, and glands hanging, filled also with the black colour; if the KIDNEY be incised longitudinally, you will observe interstices spread over here and there, and as well as these, numerous glands between the bundles of the urinary ducts, which are blood-vessels, filled with this black injection, in the form of an ornamental tree, or just as apples hang on their stems[1]." He then alludes to the vulgar notion of these bodies having a little stone in their centre, like a small marble, and with his usual modesty, whenever he was in doubt upon a subject, he offers the opinion already referred to in the following words:—

"These glands, therefore, from the fact of their being placed so numerously in almost every part of the KIDNEYS, lead me to think it probable, that they correspond with the urinary ducts, with which the mass of the KIDNEY coalesces[2]."

"As to their shape, they are very apparent from their slenderness, and transparency; so that a distinct description is not needful; nevertheless, they are seen like the round spawn of fish, and whilst the black colour is propelled through the artery, they are blackened all around; and you might say, that the extreme branches of the vessels have some also, looking like serpentine branches; with this exception, however, that the chief portion which hangs on the artery grows black, whilst the remainder retains its own colour[3]."

RUYSCH refuted this suggestion of Malpighi, and proved these bodies to be nothing more than the convolutions of an artery; but both he and VIEUSSENS thought the whole KIDNEY was a vascular body, and that the blood-vessels passed on into the urinary ducts, without any intervention of glandular structure, or substance. They injected the whole gland with red size, and, therefore, never saw any thing else than vessels, which they

[1] Vide Appendix, No. 11. [2] Vide Appendix, No. 12.
[3] Vide Appendix, No. 13.

insisted on calling sanguiferous throughout its structure. Both FERREIN and BERTIN highly condemn them for such loose modes of observation [1].

BOERRHAVE admits both the glandular secretion of Malpighi, and the non-glandular secretion of Ruysch, and Vieussens; affirming, that part of the urine is secreted from the blood, by these little bodies, and that another part is separated by an union of blood-vessels with the urinary ducts; but Bertin observes, on this anatomist's opinion, that he rests it upon no experiment or observation; but, in a mere wish, as he says, "to reconcile two modes of action in the KIDNEY:" principles, which, however, being irreconcilable, in endeavouring to establish, he has much confused himself and others [2].

I shall now refer my readers to the description left us by BELLINI of the course of the urinary ducts. This anatomist, speaking of the venous spaces, observes, that "as many capillary veins, as urinary ducts, of which we have treated, terminate within these spaces; for it may be shown that both sets of these vessels terminate at the very surface of the organ. When, therefore, the blood has passed out of the arteries, it runs into a duplex set of vessels, the one venous, the other urinary. As, therefore, the renal ducts and veins are terminated within this little space, where the blood, mixed with serum, flows on from the arteries, the serum finds these little urinary ducts, as so many syphons. adapted for it, whilst the blood is furnished with its appropriate veins;" and thus both are carried away, the serum into the urinary ducts, the blood returned back by the veins [3]. Of their continued course from the surface to the papilla, he adds, "And it will appear more and more certain, that these fibres (urinary ducts) are continuous from the very surface of the gland to the cavity of the pelvis."

It is well known, that from the accurate description first given by BELLINI, that these ducts have often been called by his name. But, although his description is very excellent, as far as it goes, yet it must be remembered, that he only followed the course of the urinary ducts, whilst passing from and through the vascular portion of the gland to the medullary structure. He failed to notice the double set of ducts in the KIDNEY, which FERREIN before him designated "white matter."

[1] Mémoire de l'Académie Royale, 1744, 1749.

[2] Bertin, Histoire de l'Académie Royale des Sciences.

[3] Vide Appendix, No. 14.

I shall now proceed to notice some of the writers of the present century, whose opinions I shall quote as briefly as I can: but the recent work of MÜLLER, on the glandular system of animals, will be my chief authority. This author has collected the opinions of all the celebrated men who have written on the subject during the seventeenth, eighteenth, and nineteenth centuries.

I must, however, first revert to BERTIN and FERREIN, both authors of eminence. The former thus remarks: "The vascular substance of the KIDNEY is of two colours, and is somewhat confused; several ducts belonging to the pyramidal bodies (*answer*[1]) to the little bundles of net-work; each bundle is distinguished from its neighbouring one by a little white space, and precisely of the colour of the urinary ducts. These little spaces, as well as the little bundles, answer to urinary ducts: they appear so continuous with them, and so to resemble them in colour, that, at first, I was induced to believe that these white spaces were urinary ducts, which came off from the sides of these little bundles, in order to arrange themselves among those (ducts) that the extremities of the bundles give off." He continues, "I hoped to be able to discover, in these white spaces, which separate the little bundles, vessels injected similar to the urinary vessels which came off from the extremities of the bundles; but I knew that I was deceived in taking these white spaces for an assemblage of urinary ducts, which, as I have said, appeared to me to come off from the lateral surfaces of the bundles. I remained, more than ever, in doubt about the structure, and the use of the white interstices. I saw the prodigious number of urinary ducts, as so many bent syphons, arranged one upon another, always leaving, however, between them, white spaces, into which the injection had not at all passed."

M. BOIVART and I tore the vascular substance from the external membrane to the medullary substance, in order to see if we could observe similar eminences throughout its whole extent: we noticed, that this substance, instead of presenting bundles symmetrically arranged, was only an assemblage of little white eminences, rounded, resembling thick papillæ, applied one near the other, and entwined the one with the other; transparent, not being in the least injected. Numerous red points were there seen; they were little globules of coloured injection, which fell

[1] The text is "RÉPONDOIENT," "answer to," but it surely must be "RÉPANDOIENT," "spread through." It is very doubtful how to take it.

from the extremities of the vessels during the time that we had torn the substance. I, at first, took them to be globules of extravasated injection; but a longer examination convinced me that these red points answered to the extremities of torn vessels. In making a section, then, with the knife, I observed that the red points were the bundles that I have described, and that the round eminences formed the white interstices, which I had observed between the bundles. That which flattered me the most, was, my being able to make out that the greater portion of the urinary ducts went, clearly, to their source within the white spaces which separate the bundles; the first, that is to say, those which come from the bundles, being easily distinguished from these by their red colour; while these have this peculiarity, that they are projecting, and appear to be the same which have been noticed by Carpi, Fallopius, and Eustachius: for, as I have just said, they are projecting; they are white; they represent so many hairs from their slenderness; and they are incomparably more numerous than the others. They all take their origin from the interstices within the bundles, and without having any connexion with them (the bundles), they take the same course: like those which come off from the bundles, they represent, as do the others, syphons of various kinds and figures, and they become more slender as they approach the papillæ."

In his seventeen summaries, Bertin concludes thus in the thirteenth: "That there are urinary ducts of two distinct sets; that those which come off from glands are extremely slender, and very numerous; that those which are the continuation of arteries are of a diameter much more considerable[1]."

Ferrein's researches are also highly important, and very interesting. He prefaces his description of the white ducts by remarking, "that Ruysch did not detect them, because he employed nothing but injected preparations, in which these ducts will become more or less tinged, and their character confused to the eye of the observer. M. F. notices, that these ducts are always perfectly distinct from the sanguiferous vessels; and that they are of a semi-transparent whiteness, almost similar to jelly. He has filled the veins and arteries with a deeply red injection, without ever influencing the white character of these ducts. Graaf and Ferrein have decided the point, that the breast, and other glandular bodies, but especially the Kidneys, are made up

[1] Bertin, Mémoires de l'Académie Royale des Sciences. 1744. p. 93.

of cylindrical ducts, arteries, and veins; these ducts being perfectly white, and carrying nothing but lymph: the same composition which Ferrein found to exist in the liver and the vascular portion of the KIDNEYS."

CHAPTER IV.

ANCIENT AND MODERN WRITERS ON THE KIDNEY.

M. FERREIN proceeds to describe the Kidney of the human subject thus: "The external surface of the Kidney appears composed of innumerable white points, about two-fifths of a line in diameter, and of different forms. Those points which have so frequently been considered as glands are separated by red spaces. They are the bases of so many white pyramids, which pass from the surface to the papillæ; they form the '*cortical*' substance in their larger part; the medullary, in their straight portion; their union together composes the whole Kidney. The red interstices, of which we spoke, accompany the ducts, and seem to denote the separation between the two: we say, seem to do so, for, in reality, it is not so; for the white matter of the pyramids exists there, but it is hidden completely by the vessels which are here in unusual numbers. This red mass is rather more marked in the *cortical*[1] than in the medullary structure." "In dissecting the Kidney, M. F. has also noticed the prolongations of the medullary substance which penetrate the vascular; they are received by the latter in so many pits or furrows, which he names '*cortical cells*,' and these are terminated by a kind of arch towards the external surface of the Kidney. These prolongations form the axes of the pyramids of which he speaks, and their number is precisely the same as those of the pyramids."

Until the time of Ferrein these canals, which are visible to the naked eye, were thought to be simple; but it follows, from the

[1] This word, "cortical," is frequently used by M. Ferrein.

combined researches of SCHUMLANSKY and this anatomist, that each is a bundle of several hundred passages, termed "the pyramids of Ferrein." Each tortuous canal is about one-sixtieth of a line in diameter. The total length of all, collectively, is, according to Ferrein's estimate, more than sixty thousand feet. There are in each lobule seven hundred pyramids; and hence, as each Kidney is composed of fifteen lobules, there are ten thousand pyramids.

But EYSENHARDT observes, further, that "each canal of the pyramids of Ferrein is composed of about twenty smaller ducts [1]."

"Thus we see," continues M. Ferrein, "that the white points are formed by an innumerable assemblage of white, cylindrical ducts; and that the red spaces which separate them contain, also, similar ducts, though fewer in number. They form the whole substance of the Kidney, with the exception of the medullary prolongations. They redouble, and collect themselves in a thousand ways, but they nowhere form any resemblance to glands. *They are all of the same size*, WITHOUT ANY DIVISION, and their diameter is equal to a thread of unspun cotton or hemp. This anatomist has frequently seen them accompany blood-vessels [2] more delicate, and which lost themselves in the sides of the '*cortical*' vessels." The space existing between all these '*cortical*' ducts is destined to lodge arteries and veins, which carry blood to and from them: but more than this, he has clearly seen a gelatinous, transparent substance in them, and has observed the same in other glandular bodies. He also found the medullary substance composed of a prodigious mass of little ducts, the one white, the others red, all extremely slender, but distinct, and separate one from the other. The most favourable condition for noticing them is in a subject advanced in age, and who has died of a chronic disease.

He then passes on to notice a difficulty which subsequent writers have only observed, but have never explained. "The red vessels are evidently sanguiferous vessels; they are those which Ruysch, who had never seen them but when filled with injection, mistook for urinary ducts. But they are not so by any means; it is the white ducts that perform this function. These ducts appear exactly cylindrical; they are much more delicate than the cortical ducts, their whiteness is also less than that of

[1] Meckel's Anatomy, by S. Doane. 1832. p. 370.

[2] Very important to know if he means "veins," or "arteries."

these last; but what is most surprising, is the number of their convolutions: they proceed onwards, continually twisting in a serpentine form, frequently even redoubling themselves, several times, upon themselves; and, forming small irregular masses, they pass on to the circumference of the medullary substance towards the papillæ: they have their origin in the '*cortical*' substance. Each of these prolongations of the medullary substance, which penetrates the '*cortical*' mass, is nothing else than a bundle of these serpentine ducts, which passes off from the inner surface of the '*cortical*' canals, where the prolongations are received. The collected ducts pass on in the medullary substance to the papillæ, contracting themselvès, though the diameter of each duct does not diminish; they must, therefore, join, and fall into one another. Though M. F. could not immediately ascertain this point in the human kidney, yet he has seen it several times in that of birds: whereas in man, where the same junction of human ducts ought necessarily to take place, the trunks appear no larger than the branches which they receive. Each of these trunks does not open immediately into the papillæ, as has been considered, by mistaking the bundles of these white ducts for urinary ducts; but each opening of the papillæ corresponds to a kind of 'cul de sac,' about one line and a half in depth, into which an amazing number of these ducts go to empty themselves. An immense number, also, of sanguiferous vessels, very visible, though more delicate than those of which we have been speaking, terminate in the sides of the white '*cortical*' ducts, and deposit the urine there, which is obliged to follow their long windings before passing into the serpentine ducts which introduce it to the papillæ."

This great author has noticed all the above appearances in the human liver, and sees a striking analogy between the liver and kidney in birds. He has perceived it in the renal glands. "These," he says, "like the Kidneys, are made up of a '*cortical*' substance which surrounds the medullary; and this '*cortical*' substance divides and subdivides into several lobules. On the internal surface of this '*cortical*' substance cylindrical vessels are found, variously doubled, and heaped up the one over the other." He concludes the whole subject by the following observations: "I do not hesitate to affirm, that the '*cortical*' portion of the Kidney, the spleen, the liver, and many other parts, are not composed either of blood-vessels or of glands. I have found that they are formed of a substance peculiar to them; and that

this substance does not consist in any wise of arteries and veins, as Ruysch pretends to have demonstrated; but that it is very distinct from either. I have also noticed, that the substance, of which I speak, is not made up either of glands, as Malpighi, and many other anatomists, think they have seen: in short, I believe that these parts are a remarkable assemblage of white cylindrical ducts, variously doubled, which I can plainly see in the Kidney; which I have seen, if I mistake not, in the liver, in the renal glands, and which, I think, I can recognise in other viscera[1]."

In a paper published the following year, M. F. corroborates, by repeated experiments and researches, all that he had previously stated with respect to the above subject.

I must now present my readers with some quotations from the works of the celebrated anatomist of our own times, J. Müller, Professor in the University of Berlin. The work[2] that these quotations are taken from, is written in Latin, and has never been published in this country. The translation, as here offered, was furnished to me by a relation[3], and it will be found to contain much interesting matter. On the subject of the Kidney, the Professor remarks, "Schumlansky explored the urinary ducts by blowing in air through the papillæ, and by repeated compression succeeded in filling the ducts with air, even as far as the surface of the Kidneys. 'The small aperture,' he observes, 'in the nipple of the papillæ is continuous with a fine duct for a line or line and a half, which then separates into two small trunks, rather less, but cylindrical. These, again, at a certain distance, are bifurcated into two others, losing little, or scarcely any of their diameter: differing in a remarkable manner from the blood-vessels, and larger than these. They proceed onwards, thus divided, in a straight line: in their progress, they repeatedly double over with many folds to the very base of the papillæ, being united to one another by a very slender cellular net-work. Proceeding hence, they become enlarged, and with scarcely any decrease of diameter, they are collected again into one or two bundles, separated from each other, respectively, and from their neighbours, by red vesicles throughout their whole extent. Each of the bundles then enters into its own canal,

[1] Ferrein on "the Structure of the Viscera," Mémoires de l'Académie Royale des Sciences. 1749. p. 90.

[2] De Glandularum secernentium Structura penitiori. Leipsic, 1836.

[3] The Author's Brother, the Rev. A. T. Corfe, Vice-Principal of Queen Elizabeth's College, Guernsey.

formed by the vascular arches or loops; having passed through these, the small ducts (contained in its bundle, and connected with it) are no longer divided, but proceed singly in the same direction through the thickness of the '*cortical*' substance, whence they branch off laterally, and extend to a very great distance in a serpentine course without branching, being interlaced with each other in a great variety of windings. Each serpentine duct, when continued from its straight course, is not inserted into the same; but, branching off laterally, preserves almost the same diameter and whiteness throughout[1]."

This author fancied he had discovered that the ends of the serpentine ducts passed into the Malpighian bodies, or the vascular pellets hanging to the small arteries. But here he is mistaken; for the ducts are always much smaller than the pellets which are said to give rise to them. "I suspect," continues Müller, "that the assertion was made by that eminent man as an old hypothesis of uncertain origin, and which had gained a sort of traditional credit by frequent repetition. For that the urinary ducts terminate in the Malpighian bodies is most certainly a false assertion."

"HALLER modestly refrains from giving an opinion upon this point, and appeals to the authority of Bertin."

"HUSCHKE, with the aid of an air-pump, filled the urinary ducts from the ureter to the surface of the gland. He succeeded best in the horse, and often found the injection pass into the net-work connecting the blood-vessels and ducts, but it never went into the Malpighian bodies."

"It is a most erroneous opinion to suppose that there is the slightest connexion between the Malpighian pellets and the ends of the urinary ducts. These bodies only hang from the arteries, whilst the urinary ducts terminate in free and undivided points[2]."

[1] Vide Appendix, No. 15.

[2] Vide Appendix, No. 16.

CHAPTER V.

ANCIENT AND MODERN WRITERS ON THE KIDNEY.

Whilst Bellini has left us an able description of the course of the ducts, and has pointed out the oneness of the vascular and of the medullary ducts, he has, notwithstanding, given us but an imperfect sketch of the whole, when compared with the writings of Ferrein, Schumlansky, and Müller. These authors observed that the ducts in the vascular portion were serpentine, and as they arrived, after their numerous windings, at the bases of the cones, they became straight, and passed downwards toward the papillæ, where they opened. Hence these tortuous ducts of the vascular part are sometimes called "the Ferreinian," whilst the straight, or medullary ones, are termed "the Bellinian ducts." Within the structure of the vascular substance of the Kidney there is a delicate net-work, which may be universally injected from the arteries and veins. The filaments thereof are smaller than the urinary ducts. Much disagreement has arisen amongst various authors about this net-work. Many have not noticed it as its importance deserves; and others have mistaken it for so many urinary ducts. This vascular net-work connects arteries, veins, and ducts in one mesh, and is most apparent at the surface of the gland. The celebrated Eysenhardt thought these filaments were urinary ducts; and he is severely censured by Müller, who charges him with having done more to confuse the subject than all other writers before him. Happily this is but the opinion of a fallible man, who is as likely to err in this matter as Eysenhardt: but then this author is also severely censured by Müller for asserting that the aforesaid ducts came off from veins[1]. I shall hope to show, hereafter, that in reality Eysenhardt was correct in some degree; for though he has falsely called these filaments urinary ducts, yet there is much reason for his statement of their venous origin. The net-work has not any office in

[1] Vide Appendix, No. 17.

carrying away the secretion, which is solely performed by the urinary ducts.

Doellinger, whilst he admits that the urinary ducts are so much larger than the smallest blood-vessels, that four or six globules of blood may circulate in them, yet he vaguely asserts, that the blood-vessels lead into the urinary ducts; though he admits that the supposed connexion between the renal artery and the ducts has not been proved to exist by any experiment hitherto contrived. But he further asserts, with much sound reasoning, that the Bellinian ducts come off from arteries and veins; and he especially insists on the doctrine of venous secretion in the Kidney. Müller alludes to this author in the following words[1]: "That the Bellinian ducts arise, not only from arteries, but veins, is very doubtful. This very talented man affirms that he has been able distinctly to recognise, after having injected the Kidney from the veins, that the veins passed into the reticular meshes, from which the urinary ducts arose, equally, as from the pellets of the arteries."

"If we trace the ducts from the papillæ through the medullary substance, up to the surface of the organ, we find this peculiar feature, that they divide into two sets over and over again, as we have already seen them described by Schumlansky; and the renal nipples in a horse are so large, that any glutinous coloured injection passes readily into them, distends the medullary and the '*cortical*' substance, exhibits this twofold division, and further shows, that the terminations of the ducts on the surface of the Kidney, are, by blind extremities, or 'cul de sacs,' within the venous circles throughout the circumference of the organ."

In the Hunterian museum (preparations 1212, 1213) may be seen sections of such Kidneys, where the ducts have been injected with white injection from the ureter, and it has passed on to the surface of the gland. Now this net-work, of which I have already spoken, encloses the urinary ducts throughout their course in the "*cortical*" structure; and because it has received injection from veins, as well as from arteries, Müller has erroneously supposed it to be the connecting capillary[2] link between these blood-vessels[3]. I shall, therefore, as I have observed

[1] Vide Appendix, No. 18.

[2] Vide Appendix, No. 19.

[3] And yet does Müller insist on saying, that "it is exceedingly rare that injection will pass from the urinary ducts into the blood-vessels;" consequently, on his own showing, he has no right for asserting, that the net-work which Huschke injected from the urinary ducts with his air-pump was a vascular or sanguiferous set of vessels.

above, hope to show hereafter, that the net-work of which Eysenhardt spoke, and which Müller here alludes to, performs another and a more important office; that it contains, in fact, A SET OF VESSELS HITHERTO UNRECOGNISED.

I do not mean to infer that Müller is incorrect in his opinion of this reticulated membrane, but that the filaments are not solely for the purpose of carrying away arterial blood into a venous channel. For if so, we should not find a minute artery or vein surrounded with numerous meshes of injected filaments, but only two or three slender threads coming off, or continued from the vessel, and carried into the vein. Instead of this, however, and as the fact is, we may easily recognise a score of fine threads, somewhat smaller than the urinary ducts, running parallel with these ducts, and ending in the papillæ: what they are, I will consider in their place. Suffice it now to remark, that the diameter of all the filaments around one minute artery would, upon Müller's own admeasurement, make a vessel three times the size of that artery which is said to convey its blood into them. For, if the artery be computed as one in size, the combined filaments, or net-work of vessels would be equal to three in diameter. And, moreover, that these filaments do not solely carry blood is plain, from the decided experiments of the most celebrated German physiologists. HUSCHKE, and even Müller, and others, have actually injected this net-work from the papillæ, that is, through the urinary ducts. Now, like the minute origins of the biliary ducts in the liver, these, also, would begin by small origins, and gradually enlarging, from other ducts falling into them, as in the liver, would soon constitute a full-sized duct. But it is not so in the Kidney, for the ducts are proved to be of the same diameter throughout; therefore, I have no doubt, that having once taken an origin near the surface, the urinary duct goes on, unaided, by fresh vascular secreting branches, whether from arteries or veins, save only those very slender ones on the coats of the ducts, the "vasa vasorum," or the vessels that nourish their fibrous texture.

Hence we must conclude, that if a duct, rising from the surface of the gland, and terminating in the papillæ, be uniform in size throughout, it receives no additional ducts from the vascular net-work here alluded to; otherwise, it would contain twice the quantity of secretion at the papillary end, compared to that where it first came off; it must, therefore, be a much larger duct at the cone and nipple, than it is at the surface of the Kidney; and, consequently, the duct could no longer be said to be uniform

in diameter throughout the gland; all of which is contrary to demonstration.

The mode in which the urinary ducts originate on the surface has already been referred to, when speaking of the various sentiments of celebrated authors upon this curious point in the physiology of the Kidneys. They are seen in birds and fishes with the aid of the microscope; and, especially in amphibious animals, they may be traced with the naked eye. All of them are traceable to the oval spaces or nets, formed by the reticulated nature of the superficial blood-vessels. Müller adds his testimony to the same effect in other glands. "The vesicles, and small branches which are collected in clusters in the salivary glands, and in the liver, may be beautifully seen in embryos, standing out a little with free and blunted ends; and in the pancreas they may be filled by mercury up to their extreme endings in 'cul de sacs[1].'"

H. RATHKE, also, asserts that the urinary ducts terminate in blind extremities.

HUSCHKE alludes to the same mode of termination, and decides the point of non-union, or non-intercourse, of blood-vessels with ducts.

Professor WEBER, of Leipsic, proves, by the injection of glands with mercury, that the ramifications of the excretory ducts in the conglobate and conglomerate glands end in "*cul de sacs*," shaped like a berry or vesicle.

It has been already remarked, that the urinary ducts preserve an equal diameter throughout their course; but I must instance the horse as an exception to this remark. The German anatomists proceed thus: "The ducts are attenuated towards the base of the cones before entering the vascular substance; and whilst their diameter at the nipple are as much as 0·01305 of a Paris inch, yet, after their bifurcation in the medullary substance, they only measured 0·00489. When traced, however, onwards, in the '*cortical*' structure, they retain an uniform calibre throughout up to the surface; and they do not present that twisted, or serpentine form, which is so peculiar in other mammalia, and in man; but they are prolonged without any appreciable undulation. When they have arrived at the surface of the gland, they branch off, and descend into the '*cortical*' substance again in the same manner that they ascended."

"All these '*cortical*' canals," says Müller, "are nearly of the

[1] Müller, Ibid.

same diameter throughout, though the superficial ones are most distinctly divided into two branches."

These second sets, or "branches," which are thus described as "branches" of the first, are undoubtedly the same as those alluded to by Ferrein, Bertin, Eysenhardt, and Doellinger; but which are not ducts at all in the sense that Müller speaks of them. They have, I repeat, a separate and distinct office hitherto unknown, and, consequently, unexplained.

The urinary ducts of a horse are four or five times larger than the finest blood-vessel, of which the diameter is found to be only 0·00037. The laborious and indefatigable exertions of the German physiologists have completely refuted, therefore, that vague and ancient doctrine which sprang up in the days of Malpighi, that the ducts came off from the loose, pendent pellets, or vesicles of the renal artery, for they can never be injected from the urinary ducts in their most successful injection. This opinion, also, fully accords with Huschke's observations and experiments.

It is clear to my mind, that the wonderful net-work, or, as anatomists term them, blood-vessels, which lie about, between, and around the urinary serpentine, or "*cortical*" ducts, has not received the attention which their importance merits.

Müller[1], in speaking of the Kidney of a squirrel, in which animal the ducts are remarkably distinct, even to the naked eye, observes, "That if a portion be cut off from the surface, and soaked in water for some hours, the connecting cellular thread between the twistings of the ducts is loosened, and the blunted ends of the latter are seen in all directions." But he then adds, "That most of them, after repeated examinations, were undivided; of the same diameter as the serpentine ducts; have, like them, obtuse ends; and were found, also, to terminate in little 'cul de sacs.' Some, again, were divided into two branches, one of which was again divided; whilst the other undivided one terminated obtusely. When so relaxed in water, they presented a hairy or shaggy appearance. How far each duct extends before it terminates, after its multifarious twistings, in blunted ends, I never could ascertain[2]."

Thus far have the modern physiologists led us in the investigation of the structure of the Kidney.

[1] Vide Appendix, No. 20.

[2] Had this eminent anatomist made the same experiment to produce the skeleton of the Kidney, which is successfully adopted by the author of this work, he would have certainly found the same results which are given by the Author in the frontispiece.

The following are the points left by them as decided :—

1st, That arteries in the Kidney have no direct union with ducts.

2nd, That the corpora Malpighiana do not communicate in the slightest manner with ducts.

3rd, That these ducts twist, and fold one over the other to an indefinite length, terminate on the surface in "cul de sacs," are uniform and unchanged in diameter throughout.

Now the main objection to the conclusion they lastly arrive at on these points is this; That because these ducts have been injected, and filled by the force of an air-pump from the nipple, and this, indeed, is no mean power of injecting; therefore, all men have concluded that the whole series of ducts so injected were URINARY. The last assertion is, and has been, the ground on which all writers have embarrassed and confused themselves, and misled their readers; so that to this hour the true anatomy of the Kidney has not been correctly set forth, and, consequently, its functions in the animal economy remained undiscovered and unknown. For since the writings of Ferrein, not one author has thrown additional light upon the subject, except Müller in his recent and most valuable work.

PART II.

CHAPTER I.

COMPARATIVE ANATOMY OF THE KIDNEY.

It is now, perhaps, time, that I should at once declare what I consider to be the nature and office of the Kidney. After the closest investigation of the minute structure of this wonderful gland, I am convinced, beyond all doubt, that, First, its nature is to act in the highest temperature of animal heat, and to thrive in unctuous warmth; and that, too, in all probability, by regular muscular contraction and expansion like the heart; for, as liquid animal oil is hotter than blood, the former being liquid at 110°, the latter at 98°, it follows, that the temperature of the Kidney must be hotter than that of the heart, to which the highest degree of heat has hitherto been assigned.

Secondly, with respect to the office of the Kidney, it is, primarily, to receive oil within its bosom, for the purposes of purifying that oil, and of lubricating the parts, and for the receiving of the DRAINS, or, as they are called, secretions, from that oil; in order to discharge them in an excrementitious form from the animal economy[1].

The office of the Kidney is, secondarily, to receive the drains also, or, as they are called, SECRETIONS from venous blood, and not from the rich, life-giving arterial blood, as is universally supposed.

And, thirdly, I maintain that the oil so purified then passes into the circulation by the trunks of the veins within the Kidney, and circulates through the system.

But before I enter fully into the consideration of the Kidney

[1] In the lower animals the Kidney varies a little, but its work is, essentially, one and the same.

of the human subject, I purpose taking a short glance at these organs as they present themselves in the various tribes of God's creatures, from the insect upwards, throughout the animal kingdom; and by glancing at that wonderful link of beings, and arriving at the noblest animal on earth, man, we shall, as I anticipate, glean much information from, and be able to form a just conception of, the nature and offices of the Kidney in all of them.

The most simple form of secretion is found among insects. They are endowed with ducts, as ably described by Malpighi, and hence termed "Malpighian vessels," which come off from the little sacs of the abdominal fat, lying on each side of the back or spine, and terminate in the intestine propè anum. These ducts, as well as the sacs of fat, have been found to contain uric acid and urea. This is particularly remarkable in the larvæ tribe. There is constantly discoverable in them a stomach, in which the chyle is formed, and this fluid, passing out of the organ, is conveyed by white tubes into the mass of fat at the sides of the thorax and abdomen. Ramdohr, Meckel, and Müller, all agree in assigning the secretion of bile to several small obtuse "cul de sacs," which carry this fluid, as it is formed, directly into the stomach; whilst these authors deny that the Malpighian ducts have any part in this function. Professors Jacobson and De Blainville agree upon the same point[1]. These eminent men assign to the Malpighian ducts the property of carrying the urine into the intestine. But certainly they do not describe their contents as drains from those sacs of oil, as I maintain they are, but as secretions from the minute blood-vessels circulating within, and upon those little sacs; being, as they assert, nothing more than a secretion from blood, which is but the old theory, but which I shall, in the course of this work, entirely refute upon evidence which it will be difficult to overthrow.

Wurzer, Brugnatelli, and Chevreuil, having repeatedly analyzed the contents of these ducts, found the same matter as Ramdohr, &c., and arrived at similar conclusions. The bile, therefore, is carried directly into the stomach. The urine, passing along these white ducts, is emptied into the intestine propè anum. These two sets of vessels, viz. the bile and urinary ducts, are also found in the chrysalis, and are clearly proved to be vessels highly important to the sustaining of life, by carrying a fluid for digestion and chylification to the stomach on the one

[1] Sur l'Existence des Reins dans les Mollusques; Journal de Physique, tom. 91. p. 318.

hand, and for conveying away the excrementitious matter from the system on the other; and this matter becomes deposited around the membranous skin, and is left within it, when the pupa state is complete, and the fly has escaped [1].

Müller has noticed the same arrangement of vessels and ducts in the scorpion. The bile is emptied from five trunks into the upper part of the intestine, or stomach. These trunks, he says, come off from venous blood-vessels within a similar number of masses of fat, having the appearance of a bunch of white grapes, which fat is continuous with that in the chest and head, called the cephalico-thoracic mass, and is there spread over the organs of those cavities. So, in the spider tribe, the middle portion of the intestine receives the secreted bile from several little branches, which come off, according to their views, from venous blood-vessels within the abdominal fat. In addition to this set of ducts, Müller has lately ascertained another to exist, having the same offices as those in the insect tribe already referred to, and analogous to the Malpighian, or urinary ducts. They open into the intestine, at some distance from the bile ducts. He further adds, that he noticed these ducts ascending along the sides of the abdomen, and all passing, by a series of trunks, into the fat here deposited. Neither were they prolonged beyond this point, but were joined by several branches, equal in size, from the anterior portion of the abdomen, whose trunks led directly into the caudal vein (vein of the tail), or else into the heart. Numerous branches, like trunks, of these latter plunged deeply into the mass of fat which lies anteriorly [2].

In most of the beetle ("coleoptera") tribe [3], the Malpighian ducts are inserted into the intestine, below the stomach, or that portion of intestine in which chyle is formed, and which is endowed with the office of a stomach.

In locusts, crickets, &c., the Malpighian vessels are the most numerous; and are inserted below the stomach, propè anum.

In gryllo talpa (the mole cricket), the vessels unite, and form one duct, before perforating the intestine.

In some of the "crustacea" the little cells of fat are extended all along the abdomen, and open into the intestine by

[1] Neither does Hybernation, in the marmot, bat, &c., put a stop to these secretions. PRUNELLE found that bats lost $\frac{1}{32}$ of their whole weight between the 19th of February and the 12th of March.—Annales du Muséum de l'Hist. Natur. tom. 18.

[2] This is analogous to the venous system of the Kidneys in birds and reptiles, so beautifully delineated by Jacobson.

[3] As the water-beetle, glow-worm, ground-beetle, &c.

two longitudinal canals; the urinary ducts open as in the other tribe, though Müller remarks, that they cannot be well delineated from their paucity; and he infers that the great mass of secretions carried off by the Kidneys in other animals, goes, in these, to the formation, and constant renewal, of the shell of the "crustacea" tribe.

Müller sums up the account of the urinary organs in insects with the following conclusions: "The Malpighian ducts, coming out of the sacs of fat, which were considered as the bile ducts, are clearly demonstrated by numerous authors to be the Kidneys, and their ducts. At least, in insects, there is another set of secreting organs which open into the intestine higher than the urinary ducts, and they open, too, in that portion where chyle is formed and absorbed; whilst the latter set open, propè anum. These contain uric acid. They are but few in number in the 'crustacea,' but in the sea bream they may be distinctly seen. In others, however, the shell receives the calcareous, or earthy salts, instead of its being sent away by the Kidneys [1]."

In the embryos of the skate and ray-fish, the liver is filled with oil, and prevents minute inspection.

In the "mollusca" many veins are distributed upon the organs, called the "calcareous sac;" and the fluid secreted in this organ in the "mollusca gasteropoda" contains a large quantity of uric acid, and, therefore, Jacobson thinks "that organ analogous to the Kidneys of vertebrated animals. Since we find the same acid in the Malpighian or urinary ducts of insects, we class this organ in the same order [2]."

The abdominal organ in oviparous animals, described by SWAMMERDAM, POLI, and BLUMENBACH, and which these writers considered was the sac for the secretion of the calcareous shell, has received much attention from Jacobson and De Blainville. It has been termed by some "the calcareous sac;" by others, "the testaceous gland;" but Jacobson has ably shown that it is exactly similar to the Kidneys in vertebrated animals. He took the fluid of the calcareous sac of the great snail, or

[1] I think Müller is wrong in this latter statement, as some creatures carry their bones outside, whilst others carry them within: as, for instance, the snail, oyster, and lobster carry their bones upon their soft parts, as is proved if we burn them, for they are reduced to lime, and not to uric acid. They are born with the scaffolding of their corporeal frame, and they carry on its further development without such a secretion as that which Müller contends for. Robiquet has detected uric acid in the Spanish fly also (cantharis).—Annales de Chimie, 76.

[2] Jacobson, De Systemate Venoso peculiari in permultis animalibus observato. Hafniæ, 1821. Edinb. Med. and Surg. Journal, Vol. xix.

escargot, (the "helix pomatia" of Linnæus,) during its hyemal sleep, when the sac is largest: he also took the fluid of the small escargot ("helix nemoralis"), the black slug, the lymnée stagnale, and the black planorbe; all of them having passed into their hyemal state of sleep. He found, by a beautiful series of experiments, that the sacs always contained uric acid [1]; whilst no other liquid or tissue, similarly treated, gave the least trace of the acid. He asserts that he could trace $\frac{1}{1620}$ of uric acid by the process which he adopted. I must refer my readers to his interesting paper for any further description [2]. In order to obtain the acid, he advises taking the excrement of birds, especially of pigeons, as the white layer enveloping it is wholly uric acid.

De Blainville remarks, that we shall find these urinary organs in the cephalous and acephalous "molluscæ" in the poulp (octopus vulgaris of Cuvier), or cuttle-fish; and in the tribe of burrets, pourpres, or purple fish, and their neighbouring species; that it is this organ, probably, which furnishes the beautiful colour of the burret, since it owes its beauty to the presence of uric acid [3].

Fourcroy, and Vauquelin, not only detected urea in the sweat of the horse, but they were the first chemists who ascertained that the colour, odour, and taste of urine, in all animals, depended upon the existence of urea [4].

In the Hunterian museum is a preparation, No. 1176, of a snail ("helix pomatia"), injected and prepared, to show the urinary gland in the respiratory cavity, which surrounds the pericardium. The duct may be observed to run along the convex side of the rectum, and it is thus described in Hunter's original manuscript: "A snail, shell taken off, air-bag opened, membrane exposed, covering part of viscera, &c., some coils of which are seen through it; on the right is the last intestine, as if a continuation of the spiral turns, and in the semicircular direction is the duct of that gland, running in the doubling of the air-bag. This, I believe, is Kidney: its mucus is like that of birds; its opening is propè anum, and accompanies the rectum [5]."

[1] It may not be irrelevant to the non-professional reader just to mention here, that uric acid, in urine, is formed after the same manner as most other acids, having for its base urea, or a saponaceous, oily substance, in combination with oxygen. It is highly poisonous if retained in the system.

[2] Journal de Physique, tom. 91.

[3] "Murex" of the ancients, from which the Tyrian dye was obtained.

[4] Cuvier's Leçons Comparées, tom. v. p. 257.

[5] Cat. of Hunter's Mus., vol. ii. p. 113.

The slug (limax ater, Linnæus) has its urinary gland surrounding the pericardium. It contains, in both instances, urea and uric acid.

Hunter observes upon the Kidneys of non-vertebrated animals, that "most of them have no such organs that are visible; although it is probable that in them other common parts may serve the same purpose, or perform the same action."

Since this celebrated man's remark, it is clearly proved that the ducts coming off from the abdominal sacs of fat, carry urine.

CHAPTER II.

COMPARATIVE ANATOMY OF THE KIDNEY.

I shall now proceed to give a brief outline of the Kidneys in VERTEBRATED and INVERTEBRATED animals. In the majority, it may be said, the secreting vessels are small ducts, running down sometimes in a straight course, or twisted; of nearly the same diameter throughout, and, according to Müller's recent observations, they always terminate in blunted "cul de sacs." "In all animals, these small urinary ducts begin with stem-shaped vesicles, the stems going on continually to increase. A fact ascertained from the history of the development of amphibious animals, birds, and mammalia."

"In some fish, and in frogs, the small ducts are nearly parallel, or straight, or a little bent, and are fastened to the lateral ureter."

"Such, also, is the case in other fish, and in serpents; but the small ducts are collected into lobes, and are twisted one within the other [1]."

"The Kidneys are in pairs, from fish upwards; but below fish, as in the cuttle-fish, and snail, &c., there appears to be only one [2]." This is the testaceous gland which Jacobson, and others, have demonstrated to be the Kidney; and containing uric acid. From fish, upward, they may be said to be placed within the belly of the animal, near to the back; but below them it is not

[1] Müller, Oper. cit.

[2] Hunter's manuscript in Catalogue of Royal College of Surgeons, vol. ii.

so determined where they may be placed. The cuttle-fish has the Kidney in the anterior part of the belly; the snail, as we have already seen, has it by the lungs. In some orders of animals, they are very circumscribed bodies, being enclosed in a proper capsule or membrane, as in the most perfect orders, and in some degree so in amphibia; but in fowl they are more obscure, being placed in the hollow of the pelvis; while in fish they are still less detached, lying all along the furrow made by the spine, and are closely attached to the parts behind, not having there any particular capsule. In some animals the Kidney is a very oblong body, extending in length for a considerable way, and very narrow, as in some fish; while, in other animals, it is almost globular, as in the leopard. In some, the external surface is smooth and regular, as in the human subject: in others, it is covered with large branches of veins, ramifying on it, as in the lion and cat, or feline tribe, &c. In others, again, the whole mass is lobulated into several parts, and very irregular on its surface, as in oxen, and in the fœtus of the human subject.

The consistence of the Kidney is, in general, a pretty solid substance, but most so in the most perfect animal; appearing to become less and less so in the inferior orders; for in fish they are of a very tender substance, and are of still more delicate texture in the snail. In the inferior orders of animals the Kidneys are pretty much of the same uniform substance throughout the whole[1].

The arteries to the Kidneys in Fish arise from the aorta, by numerous branches, as it passes along the spine; and this great artery is giving off arteries to the Kidneys through the whole course of the glands, and, therefore, there are a vast number of small arteries going to these bodies. The renal arteries may be thus seen in a frog, when the arterial system is injected. The urinary ducts of the sea-lamprey, and the cramp-fish, are much larger than those in animals that are remarkable for the size of these ducts, as the squirrel: the diameter in the former being 0·00469 of a Paris inch, whilst that of the squirrel is 0·00149. In birds it is usually 0·00174[2].

In fish, the numerous origins of urinary ducts, which, at their source, are transparent, become opake as they enlarge, and often gradually assume a silvery colour. Their branches unite into one trunk, as in other classes. The ureter which passes out at

[1] Hunter, ibid.

[2] Müller, Oper. cit.

the lower part of the Kidney either terminates in an urinary bladder, or in a cloaca, or, uniting into one, they empty their contents into a peculiar dilatation, termed the cloaca [1].

But whether the substance of the Kidney is formed by branches of the ureter, or whether the ducts are simply a continuation of the lateral branches of the ureter, yet they invariably cease in obtuse extremities. In the dolphin, the gland, like most others among fish, consists of an assemblage of small lobes seated on the branches of the ureter; each lobe being made up of small round lobules, joined in tufts, and seated like clusters upon the ureter. On one side of the lobule is seen an orifice, into which the branch of the ureter passes; and a small calyx, or cup, surrounds the aperture. In each lobule there is a separate nipple, the summit of which is surrounded by vascular substance. The lobules consist, as in mammalia, of serpentine "*cortical*" and straight medullary ducts. The division of each substance in the lobules is similar to that of other classes of animals, inasmuch as the urinary ducts, originating from the nipple in fasciculi, or bundles, are afterwards collected, become more and more prolonged, spread outward and widely in their serpentine course, and thus form the vascular or "*cortical*" substance.

From the small calyx, or cup, surrounding the aperture of the renal lobule, come off, what I have designated in this work FLOCCULENT FEATHERY OIL TUBES, shaped like a feather, and which allow the oil that has passed up between the layers of the cup and ureter to pour out, according to my demonstrations, its watery secretion into them, to be mingled with that secretion or drain from the blood found in the urinary ducts. The combined fluids then constitute urine, and not before.

It will be seen hereafter that what is here done in the formation of these FEATHERY OIL TUBES, by each cup or calyx, in the higher animals is accomplished by thousands of tubes coming off from one loop only of a cup. The cup in mammalia is usually crescent-shaped, and from one side alone of the cup may be seen countless tubes conveying the secretion from oil to the cones, or excreting portion of the Kidney, and thus forming urine.

In the ray tribe the urinary ducts are very large.

In the Museum of the Royal College of Surgeons may be seen a beautiful preparation of the Kidneys of the "lump-fish," minutely injected. The gland is cut through, and on the incised

[1] Leçons d' Anat. Comparée, Cuvier, tom. v.

surface, the vein, which distributes branches through the gland for the secretion of urine from venous blood, as is generally supposed, is laid open. But I shall have to refer to this extraordinary venous peculiarity, in other tribes as well as in fish, hereafter.

In the Kidneys of whales, or tribe cetacea, as well as in the bear and otter, the renules are numerous, and not connected with one another by continuity of surface, as in the human species, but are united by cellular membranes, blood-vessels, and ducts, &c. "The whole gland, in a whale, is an oblong flat body, broader and thicker at the upper end than the lower; and has the appearance of being made up of different parts placed close together, almost like the pavement of a street[1]."

I must, however, in this place, refer my readers to one of the most valuable papers on the physiology of the Kidney, in some classes of animals, which has appeared for half a century.

Professor Jacobson, in his discoveries, thus writes: "In the venous system of several genera of fish, as the carp, tench, and barbel kind, the herring, pilchard, and shad kind, &c., the blood of the posterior, and, very often, of the middle part of the body, flows to the Kidneys. The caudal vein (vein of the tail), when it reaches the Kidney, is then divided into two principal branches, which, having received single trunks from the middle part of the body, are divided in the Kidneys. In the genera furnished with large Kidneys, part of the veins, like individual trunks, pass from the middle part of the body to the Kidneys; from these the vena cava arises, for the veins which convey back the blood from the Kidneys (the renal, or 'venæ renales revehentes' strictly so called), unite with the veins of the ovaria," &c.

This arrangement of the venous system is found in the ray, shark, pike, and flat fish, &c. &c.

The third modification, almost similar to the last, differs from it in this one circumstance, that the caudal vein, besides the veins going off to the Kidneys, gives a large branch to the venæ portæ, or secreting vein of the liver; so that the blood of the posterior and middle part of the body is conveyed partly to the Kidneys and partly to the liver. The vena cava exists quite in the same manner as in those fishes whose venous system is formed according to the second modification. This peculiarity

[1] Hunter on Whales. Phil. Trans. vol. lxxvii. p. 412.

has been observed in the eel family, frog-fish and toad-fish family, &c.[1]

Cuvier, in his Comparative Anatomy, mentions this peculiarity in the venous circulation of the Kidneys in fish; and Hunter has put up a preparation (No. 1186), to show the same structure in them.

CHAPTER III.

COMPARATIVE ANATOMY OF THE KIDNEY.

In amphibia and fowl, the Kidneys are more compact than in fish; their arteries being less numerous, and larger, in proportion. Their excretory ducts are, in general, mixed everywhere with the secretory, forming a regular ramification of branches and trunks; the last and largest trunk becoming an ureter. I am, moreover, disposed to infer, that throughout the whole class of animals, up to man, that the secretory and excretory ducts are one continuous line of surface; and that the simple form of secretion, one long distinct duct, as in the scorpion and insect tribe, constitutes the epitome of all the higher animals; though, from thence, it does become more and more complicated as we ascend the scale of perfect organization.

In reptiles, the Kidneys are not distinguished into the vascular and medullary structure, as in the mammalia. Their situation, form, and size vary among different orders.

Those of the turtle and tortoise (chelonii), and of the lizard tribe (saurii), are close upon the spine; oval, and all the lobules uniting in the centre. They form a curious convolution, not unlike the cerebral mass, and present a singular appearance. In the turtle tribe (chelonii), the ureter terminates in a bladder;

[1] Jacobson, Oper. cit.

but, usually, in the amphibia, it ends in a cloaca, and the bladder is wanting.

In all amphibious animals the venous system assumes the modification which Jacobson classes under the third head; varied, according as the posterior extremities, or the tails of the animal, are larger. The Kidney derives veins, also, from organs peculiar to these animals. This gland is distinguished by Jacobson as the proper organ, which consists either of a double membranaceous sac, opening into a cloaca, and very frequently containing a pellucid fluid, or an oblong membranaceous sac, filled with fat, and united, also, with the cloaca[1].

In the turtle the organ, performing the office of Kidney, surpasses that of others in size; it is composed of a cellular membrane, extended over the whole inferior part of the body, and filled with fat. In the frog, they are in the back part and lower end of the cavity of the abdomen, being in contact with the urinary bladder. They are surrounded with fatty appendages, and there are also two fatty processes of the peritoneum, which perform an important office; probably, in retaining the heat of the body whilst immersed in water; though this idea, which is suggested to my mind by Hunter's observations upon fat, &c., can scarcely hold good, inasmuch as the same processes are found alike in the toad, the rattlesnake, and iguana[2]. I think we must conclude, that they, also, as well as the fat around the Kidneys, have their important office in the formation of bile and urine.

The bladder in frogs is bifid; it is thin in structure, and of considerable size. "There is reason to suppose," remarks Hunter, "that besides serving as a receptacle for urine, it acts, also, as an aquatic respiratory organ, receiving water from without, which affects the blood that is distributed over the walls of the bladder[3]."

[1] That is, it answers to the Kidney of insects.

[2] And in the latter they are of large size, divided into an upper and lower lobe, and attached by a narrow process to the sides of the bladder, to lubricate, also, by appropriate ducts, most probably the internal surface of this receptacle, and perform the important office of generating animal heat, by pouring oil into the bladder, to be absorbed by the numerous blood-vessels spread over the internal surface.

[3] This peculiar formation may serve to explain the curious fact noticed by Tiedeman in frogs, "that at night, when the water was frozen, a frog had the temperature of 33° Fahr., and the water around it was unfrozen; whilst, on the other hand, these reptiles have the power of preserving a low temperature when surrounded by a high temperature, their natural standard varying between 46° and 48° in all seasons."

Respecting the turtle, this idea of Hunter seems peculiarly striking, for in this reptile the ureters do not enter the bladder, but open by projecting papillæ, at some distance below the constriction which seems to form the neck of the bladder, into which the urine must pass by regurgitation, if it be ever retained in that receptacle [1]. I should be more inclined to think that the bladder was a receptacle for aquatic respiration, through water, and animal heat, by the curious process which has already been referred to in frogs; for it further appears from CZERMACK's experiments, that the frog and tortoise are the only two reptiles mentioned, the temperature of whose bodies was the least altered by the altered temperature of the media they were placed in; thus:

Water being at 44,
A frog's temperature was . . 48.
Air being at 54,
A frog's temperature was . . $46\frac{1}{4}$.
Air being at 85,
A tortoise was . . . . 84.

But in that of snakes Dr. DAVEY found their temperature always 7 or 8 degrees above the surrounding atmosphere [2]. Thus it must be granted, that the curious structure of the bladder in the frog and tortoise enables these reptiles to preserve something like an unvarying temperature, even in the most intense cold; and more even than this, it enables them to generate animal heat, by some such vital process within as the one I have alluded to. This is the mode by which the hybernating animals are preserved with a due temperature, viz., by the absorption of their Kidney oil; and why should not these reptiles be similarly preserved in their natural temperature?

In the crocodile (croc. acutus), and alligator (croc. lucius), the ureters terminate in a circumscribed space below the valve of the rectum.

The caudal vein (or vein of the tail), in the turtle tribe, united in various ways with the vein of the posterior extremities, forms the conveying renal vein of each side. The other crural veins (veins of the thigh), with those returning from the "proper organ" (the Kidney), in different places, form, in part, a secondary or accessory conveying renal vein; partly, at the inferior parts of the abdomen, pass to the liver, either separately or united, and there unite with the portal vein.

[1] Hunter's Catalogue, vol. ii. p. 189. [2] Müller's Physiology, by Dr. Baly.

The caudal vein is composed of the returning veins of the Kidney, and ovaria, &c. &c., as in other amphibia.

As I have remarked, already, the urinary ducts in the frog are straight or parallel; and in serpents, they are twisted in a serpentine manner, and form small lobes, which are placed upon the ureter.

In crocodiles and tortoises, there is a branching ureter; the surface of the Kidneys is distinguished by the twistings of the small lobes, the urinary ducts being directed in a straight course towards the surface of the small lobes. The ureter branches out in the twistings of the lobes, from whence the urinary ducts go off severally on either side, towards the surface of the Kidneys. The ducts end in "cul de sacs." Müller has never yet seen the cryptæ, or vesicles, in the arteries of crocodiles, serpents, or in fishes; but they are seen in frogs, toads, tortoises, and birds [1].

In the serpent and lizard tribe (ophidii), the right Kidney is much more forward than the left. They are only held to the vertebral column by a prolongation of peritoneum, which conformation, no doubt, depends upon the extreme suppleness of this column. The gland is formed of a great number of separate lobes. The principal branches of the urinary canals join, as they leave each lobe, into one common trunk, and form the ureter. Just before they open into the cloaca, by separate orifices, each ureter dilates into a little oval pouch [2].

The organ, designated "the organ," or Kidney, in this tribe, consists, according to Jacobson, of two long membranaceous sacs, filled with fat. The venous system is composed of the caudal vein, which, being divided, goes to the Kidneys; and the returning renal veins anastomose with the venæ portæ. The veins of the Kidney, and of the anterior abdominal muscles, form a primary trunk, which flows into the venæ portæ, above its entry into the liver. But after it has entered this organ, it receives some smaller branches from the anterior abdominal muscles. The vena cava arises from the proper renal veins, or those which return the blood, and which have union with the veins of the ovaria, &c. &c.

In the crocodile (saurii) tribe also, the Kidney (or "organ [3],") consists of a membranaceous and cellular sac, filled with fat, and situated on each side of the abdomen. The caudal vein unites with the ischiatic vein, and a branch of the crural vein, and in this way forms the vein going to the Kidneys. The other

[1] Müller, Op. cit. [2] Cuvier, Anat. Comp. [3] Called "organ" in the text.

branch of the crural vein, uniting with a similar one on the other side, receives veins arising from the "proper organ," and inferior abdominal muscles, passes to the portal vein, and pours the blood into it before it enters the liver. Some veins arising from the anterior part of the abdominal muscles, pass through the liver, and flow into the trunk of the portal vein.

The vena cava is formed in the same way as in the animals already mentioned.

In the frog and toad (batrachii) tribes, the Kidneys are very close one to the other, and have no division in the lobes as in the preceding, and are covered with peritoneum only, on their lower part.

Their "proper organ," the Kidney, resembles a membranaceous sac, communicating with the cloaca. The vein of the tail, which is small, unites with the ischiatic vein, and having received an anastomotic branch from the vein of the thigh (crural), forms the conveying renal vein. The other branch arising from the crural, proceeds to the inferior part of the abdomen, and there unites with a corresponding branch of the other side, receives the returning veins from "the proper organ," and forms a common trunk; and having received the veins arising from the muscles of the lower part of the abdomen, proceeds to the portal vein. The origin and distribution of the inferior cava is the same as in the other amphibia.

In the Hunterian Museum is the preparation of a Kidney of the alligator (1189) with its lobules unravelled, whereon is seen the superficial branches of the ureter, filled with the white secretion of the gland.

CHAPTER IV.

COMPARATIVE ANATOMY OF THE KIDNEY.

The Kidneys of Birds are ordinarily buried behind the peritoneum, within several bony pits formed in the pelvis. Their shape is always irregular, more or less elongated; depending

partly upon the bones against which they lie. They are usually divided into fissures, more or less deep; the first lobe being generally separated from the rest, and so forms the largest portion of each Kidney.

Their size appears larger, in proportion, than in the mammalia; and their consistence is much softer. The artery comes to the first lobe from the aorta; but to the other lobes, from the femoral.

We cannot trace two substances as in the mammalia. The ureter begins in the substance of the Kidney by a multitude of little roots, extremely fine and delicate, which are seen throughout the Kidney, and unite in forming hair-like ducts. The union of all the branches of the lobes, constituting the ureter, then passes from before, backwards, as far as the cloaca, and opens at the upper part of its walls.

In the cormorant, ostrich, and pelican, no lobes are visible, but their substance seems composed of a large number of lobules, which are not more distinct within the body of the gland, than without.

In the ostrich, the ureter is hidden, at the posterior end of the Kidney, in a deep furrow[1].

The internal structure of the Kidney is better seen, in this class of animals, than in any other; especially if they are allowed to become slightly putrescent.

The Kidneys have no pelvis, and the ureter has a large number of branches which go off to the various divisions of the gland, within which it is lost; all these branches perform the same office as the calyces in other animals.

The ducts, known as Ferrein's white "CORTICAL" ducts, are also met with in birds, as well as in man. The cortical ducts, however, are redoubled, and heaped together one upon the other, in different ways; whilst the medullary ducts, on the other hand, are arranged in bundles, without forming loops. Both sets of ducts leave between them a small space wherein is lodged the blood-vessels, and a small quantity of spongy flesh (parenchyma). One may easily be deceived respecting the number of these white ducts, for some Kidneys are seen with naked or empty spaces: this most probably arises from the white matter, forming these ducts, having disappeared, and so they are rendered invisible; but on an examination of other Kidneys, it will be seen that the same spaces are filled with ducts as described.

[1] Cuvier's Comparative Anatomy.

The cortical ducts of birds differ, in one essential feature, from those of the human subject.

The medullary ducts of the human subject are somewhat finer than the "*cortical*;" the medullary, in birds, are larger than the "*cortical*," and as their number diminishes, their calibre increases.

The termination of the ducts in the mammalia, is not in the points of the papillæ, but in small spaces, or pits, which correspond to the perforations with which the papilla is pierced: in birds, however, there is no papilla; but the trunks of the medullary ducts pass into several other small and very short trunks, which communicate with the branches of the ureter, and perform the office of those little pits alluded to in the human subject [1].

Müller describes the urinary ducts in birds, as united into bundles, which adhere to the branches of the ureter, &c. They terminate, he adds, in rounded or obtuse "cul de sacs," on the surface of the gland [2].

This physiologist observes in a subsequent work, that in the old bird, the ducts can, by the aid of atmospheric pressure, be injected with size and vermilion; and that then the disposition of the ends of the urinary canals, on the surface of the Kidney, presents a beautiful appearance.

Ferrein, having compared the structure of the liver of birds with that of their Kidneys, has scarcely detected a shade of difference; and oftentimes he has mistaken the one for the other. He asserts that the white cylindrical ducts which are so clearly seen in the Kidneys of birds, and appear to be arranged in the same manner as those in the human subject, are similar in both [3].

In the class of birds, the venous system is arranged and composed according to the third modification of Jacobson. Here there are fewer variations, and those too of less importance.

The caudal, ischiatic, and crural veins, united in different manners, flow to the Kidneys, distribute their branches there, and give off a larger anastomotic branch to the portal vein. But the crural vein having given off a superior branch to the superior lobe of the Kidney, and the inferior branch being united with the ischiatic vein, gives off a middle branch going to the vena cava.

The vena cava, as in the animals of the first class, is composed of the returning veins of the Kidney, and of the veins of the

[1] Ferrein, Mém. de l'Acad. Roy. des Sciences, 1749, p. 101.
[2] Müller. Oper. cit. [3] Ferrein, Oper. cit.

ovaria, &c.; and having received branches from the crural, forms a trunk. All the blood, therefore, which in birds returns from the posterior part of the body, is carried partly to the Kidneys, partly to the portal vein, and partly, but in small quantity, is conveyed in a direct manner to the vena cava.

In a beautiful drawing of the blood-vessels of a common fowl, in the Hunterian catalogue, some of these veins are seen; as two that transmit blood from the muscles of the tail, and from the posterior lobes of the Kidney, and then enter into the portal vein.

Jacobson concludes, therefore, that this venous system in animals of different classes, in many respects differing from each other in structure and organization, exhibits a perfect and complete analogy of composition. He is convinced that it is destined to convey the venous blood, returning from the posterior or middle part of the body, to the Kidneys, or to the Kidneys and liver; and regulates in those organs the functions of secretion. Hence, in birds, reptiles, and fishes, according to this author, the secretion which takes place in the Kidneys is effected by means of veins and venous blood.

CHAPTER V.

COMPARATIVE ANATOMY OF THE KIDNEY.

The Kidneys in the Brute Mammalia are essentially similar to those of man, in their minute structure. The supply of blood is also similar. The vascular and the medullary substances are alike distinguishable. Their position, their form, and the relative thickness of the two substances vary, and so does the presence or absence of the papillæ and pelvis.

The right Kidney in man is the lowest. The right in brute mammalia is the highest. They are globular in the cat tribe;

elongated in the hog tribe; almost cylindrical in the lama; triangular in the horse.

But the most important difference of the Kidney, amongst the varied tribes of brute mammalia, relates to their division.

In the cat, the surface has several large projections, separated by slight fissures or furrows. In the elephant and ox, the lobes are well separated; and we may count from 26 to 30 in the latter, and only four in the elephant. They are most distinct in the bear, and are in reality, as in amphibia, so many little lobules, each alike.

Cuvier, seeing the same conformation in this organ of the fœtus of the human subject, at first, suspected that it arose from the amphibious nature of the creature; but then, his reasons fell groundless, when he found the same division in the marmotte, the bat, and the bear. He then suspected it to arise from the hyemal nature of the animal, as in the latter beast; but the ox and elephant presented the same difficulty, and he confesses he knows not why this conformation should exist among many tribes.

In the lion and the ox, there is a hollow, more or less deep, instead of a rounded slope, for containing the pelvis and ureter, and by which the vessels enter.

The extent and character of the two substances is usually well marked; except in the elephant, where the substance of each Kidney, besides its extreme softness, presents a series of white lines, which pass, in a diverging course, from the papillæ to the circumference of the organ, and form the only character by which the medullary and vascular substances can be distinguished.

The minute anatomy of organs was unknown to Cuvier; and therefore, in his description of the Kidney of mammalia, but especially of the elephant, he was not prepared to say, what these white lines were; but it is clear, that they were, as may be seen in this beast, those white cylindrical ducts of Ferrein; the especial office, and hitherto undiscovered uses of which, I shall shortly proceed to point out.

The medullary substance does not always terminate in papillæ, among mammalia. In some animals the parts which transude the secretion are concave, and united together, instead of being in separate points, as are the papillæ in the human subject, and the ox. We find it thus in the cat, dog, phalangers, tatoux, &c. But the substance is equally as pale at the points, as are the points of the human papillæ.

Sometimes, there is but one papilla, as in the lion, the coati,

the squirrel, the hare, the Indian pig, and the deer. Rats have two; and we may count one, to each little lobule in the otter, the seal, and the bear. There are but three or four papillæ in the echidne, as well as in the elephant; and the calyx answers to them; but there is no pelvis. When there is but one papilla, the calyx of the ureter embraces the whole surface of it, from which the secretion is poured. It sends off, however, numerous branches, which penetrate the vascular substance; and are, in this respect, similar to the calyces and branches in the human subject. Indeed, I am of opinion, that if we search the whole creation throughout, we shall find, that where there is red blood, there also will be seen a branching ureter, penetrating the vascular structure, and conveying in its bosom an oleaginous substance throughout the glands, varying in consistence from suet to limpid oil, from which ureter the "FLOCCULENT OIL-TUBES" are given off, to join the true urinary ducts, coming from the veins of the Kidney.

There is no animal whose urinary ducts can be better injected than those of the horse, ass, and zebra. Because the chief obstacle to a successful injection of these ducts in other animals, arises from our inability to fill these ducts throughout their whole course from the papillæ, to the surface of the gland; but in this class, the ducts terminate on a concave surface in the pelvis of the Kidney, by orifices that are visible to the naked eye. If they are injected with red size, the blunt ends of the ducts on the circumference are very conspicuous. So that the most slender are four or five times larger in diameter than the finest blood vessel. For these ducts, according to Müller's admeasurement, are 0·01305 [1] at the papillæ, but after their bifurcation in the medullary substance, the measurement of them is 0·00489; and at the surface of the Kidney, they are 0·00137 to 0·00182; whilst the blood-vessels of the most slender proportions are not more than 0·00037. It is, therefore, a matter of surprise to my mind, that Müller and Huschke should have employed such force in this experiment on the Kidney of the horse, as the use of the air-pump necessarily produces. HUNTER has put up several preparations, in which the same ducts have been filled to the surface, by a common syringe, with size and vermilion, and especially the preparation 1208.

[1] Of a Paris inch.

It needs no such power as that of an air-pump; an ordinary mode of injecting will fill these ducts nearly as readily as the blood-vessels of the glands in other animals may be filled. Indeed, I very much question the propriety of taking the statement of any man when he has employed such a mode of injecting as that of the air-pump. For who can say what parts he bursts through, and breaks down, in an organ so exquisitely delicate as this gland, in its structure, is known to be?

We never find the injection pass from these ducts into the Malpighian bodies, or cryptæ[1]; and it is extraordinary that there should be found any one who would persist in clinging, with tenacious grasp, to the doctrine of union between these bodies, and the urinary ducts. Müller's admirable work on the glandular system should be read by such theorists, that they may there see the untenable ground of their opinions. But more of the subject hereafter.

In the horse, as in other animals, the ducts are repeatedly bifurcated. But the expression, bifurcated, must be received in a limited sense, and that only in describing the course of the ducts from the papilla to the surface, as set forth by Müller[2].

They are apparently so when thus traced, but are not so in reality. For if we trace them from the surface of the Kidney to the papilla, we shall easily understand why their diameter so rapidly increases. We find each urinary duct joined by another and another "*duct*," as they term them, but according to my demonstration, an adjunctive feathery oil tube, after leaving the surface, and again by a third, and fourth, and so on, till each little collection forms a bundle, before it contracts itself into the medullary structure. These again unite with others, and thus arranging themselves in different compartments, produce the appearance called the medullary structure. My "FEATHERY OIL-TUBES," that so join these urinary ducts in their descent from the surface to the papillæ, are a distinct class of tubes.

The most interesting animals for the demonstration of these FLOCCULENT FEATHERY OIL-TUBES, are the ox, sheep, calf, lamb, young pig, rabbit, and hare, and the Kidney of the females are more suited to the exhibition of these FEATHERY OIL-TUBES than those of the male. Of the latter sex, the Kidney is more compact and firm than in the female gland. Why it is so, I may attempt to

[1] Vide Appendix, No. 19. [2] Vide Appendix, No. 20.

explain. All classes of birds offer, also, a striking and beautiful example of these "FEATHERY OIL-TUBES," if they are unravelled and dissected in the manner I have adopted in the pursuit of these enquiries.

It is true that they convey some of the constituent parts of urine into the urinary ducts. These constituents are water, urea, and some salts, as lime, potash, and iron, derived exclusively from OIL. Their contents are no more urine, before they enter into, and join the urinary ducts, than portal blood in the liver, from which bile is derived, is actually bile, until it enters the lobules of the liver, and joins the minute biliary ducts. For, as I shall show, the portal blood going into the liver is richly supplied with OIL, "after its kind," and this oleaginous blood is the fluid from which bile is wholly derived. The oil is not of the same character, or possessing the same properties, as the renal oil, or suet, and, consequently, the secretion from it is also dissimilar. Yet portal blood in the liver stands exactly in the same ratio to bile, as the fluid, which passes out of these FEATHERY OIL-TUBES into the urinary ducts, does to the urine. There is oil for bile on the one hand, and there is OIL FOR URINE on the other.

Thus the liver and the Kidneys may be viewed as the organs adapted for purifying the system of its nitrogen; whilst the lungs purge it of its carbon. For bile and urine are highly azotized fluids, whilst expired air is a highly carbonized fluid.

This will not appear so surprising when it is considered that FOURCROY and VAUQUELIN prove that the odour and colour of the renal secretion depend on urea; and DE BLAINVILLE affirms that the beautiful purple dyers' tint of the pourpre, burret, or purple fish, also depends on its urea. This substance, or salt, I affirm to be separated from fat, OR OIL, in the lower, as well as in the higher, animals, as I have already pointed out; and that, too, where no blood is engaged in the secretion: doubtless the same salt, derived also from OIL, in the higher classes of animals, gives to the urine its tint and peculiar odour. Having been so purified of its urea, the OIL PASSES INTO THE VEINS FOR GENERAL CIRCULATION by appropriate channels, to be described in the sequel.

Müller has succeeded in injecting the urinary ducts in the horse's Kidney, and has discovered that the urinary ducts, as he and others term them, anastomose freely in the ureter. These ducts are none other than FEATHERY OIL-TUBES, pouring their lubricating oil over the surface of the duct, to guard it from the pungent acrid secretion of the gland.

CHAPTER VI.

COMPARATIVE ANATOMY OF THE KIDNEY.

WITH respect to the arrangement of the ARTERIES and VEINS of the Kidney, in brute mammalia, there is nothing remarkable, or otherwise differing from the order in which they run in the human subject, save only with the lion, cat, hyæna, leopard, tiger-cat, serval, tiger, suricate, and seal, &c. &c. In these animals the veins are singularly arranged. Seven or nine large branches fill the furrows, which exist between the different lobes; pass on, converging, or anastomosing, and increasing in diameter towards the hollow entry of the organ, where they empty themselves into the renal vein. Their internal surfaces are studded all along their course with minute orifices, which are the points where the small veins from the interior of the gland come out to enter them, in the same way that the large veins around the cones of the medullary structure in the human subject are also observed to be studded for the same purpose. In short, these veins in the above tribe are disposed somewhat like the sub-lobular hepatic veins of the liver, according to the splendid discoveries of Mr. KIERNAN[1].

But although these veins have been, hitherto, only looked upon as mere receptacles for some of the blood from the interior of the gland, yet I am not at all disposed to think their importance ends here.

It will, probably, be found, on further investigation, that these superficial veins receive the blood from those veins which have given out some of the constituents of urine; viz., the blood of the vascular substance; whilst the smaller and internal veins are set apart for receiving the oil within the body of the gland, as will be explained. And if such be proved to be the case, it will correspond to a system of organization which, I suspect, will be found in many of the lower classes of mammalia: or, in other

[1] Phil. Trans., 1833.

words, that there exists a set of veins for receiving oil, and a set for the secretion of some of the constituents of urine. I say some of the constituents, for the bulk of the urinary secretion is derived from oil, and not from blood; and the blood so employed is purely venous throughout all mammalia, including, of course, the human subject.

The Malpighian bodies of the Kidney are found in all vertebral animals. In the salamander, HUSCHKE has seen what he terms the blood-vessel enter these bodies, and issue from them again. They are filled from the arteries with ease, but with some difficulty from the veins.

CHAPTER VII.

COMPARATIVE ANATOMY OF THE KIDNEY.

BEFORE I leave this branch of the subject, I am desirous of laying before my readers a short sketch of the chemical analysis of various urinal secretions in insects, birds, and beasts. We have already seen that the labours of the German physiologists and chemists have clearly proved the existence of uric acid and urea in the Malpighian or urinary ducts of spiders and beetles; in the crustaceous and molluscous animals, as the turtle, tortoise, and snail; in various flies, as the Spanish fly[1], &c. &c.

These vessels or ducts secrete during the development of the pupa, when no food is digested. They are, therefore, vessels of great importance and interest, since they are especially destined, according to my opinions, for the purification of the circulating oils of the animal.

[1] Uric acid, combined with ammonia, has been found by Dr. PROUT to constitute upwards of 90 per cent. of the excrement of the boa constrictor.—Thomson's Annals, p. 413.

Dr. J. DAVY observes, that the urine of frogs and toads is very watery, and contains common salt, uric acid, and a little phosphate of lime.

The urine of serpents and lizards, &c., becomes solid soon after excretion, and contains many salts of uric acid, but no free urea.

The composition of urine not only differs essentially in the different classes of animals, but it becomes more and more complex as we ascend the scale of animal creation; and so arising from the simple to the compound, and more intricate organization of animals. Hitherto urea is found to be a constituent of the urine of all animals; and this must necessarily follow, if, as I shall hereafter show, urea be a secretion exclusively from oil, and not from blood: and that, therefore, we must conclude, that the Kidneys in all animals are destined for the purification of oil first, and then of blood.

The urine of domestic fowls, which is voided with the excrement, contains uric acid; and Dr. Wollaston has determined the proportion of uric acid to be greatest in the urine of birds which feed on animal food. In the hawk, which was fed upon flesh only, it was remarkably abundant; but the gannet, feeding solely on fish, discharged no solid matter, except uric acid[1].

The urine of the ostrich, examined by Fourcroy and Vauquelin, is as white as milk: it is usually mixed with more or less excrement; but when separated from this excrementitious substance, it deposits the matter which gives it its milky character, viz., the urate of ammonia, and then becomes transparent, and but slightly coloured. It consists, according to these chemists, of, 1st, uric acid; 2nd, sulphate of potash; 3rd, sulphate of lime; 4th, muriate of ammonia; 5th, an animal matter; and, 6th, of an oleaginous substance[2]. Ignorant as these gentlemen were of the true office of the Kidney, they are naturally surprised to find uric acid in the secretion from the Kidney of an animal that lives solely on vegetables. This discovery led them to examine the excrementitious matter of other birds; and amongst these they took the domestic fowl, the turtle-dove, the vulture, the eagle, and several aquatic birds, and in all of them there was abundance of uric acid. The quantity was remarkably great in the carnivorous birds, as Dr. Wollaston observed; so that these animals pass from three to four ounces at a time, without any admixture of solid or other excrementitious matter[3]. The shell is formed in the cloaca, and is found to contain uric

[1] Phil. Trans. 1810.

[2] Annales de Muséum d'Histoire Naturelle, tom. xvii. p. 310, &c. 1806.

[3] If this fluid be allowed to settle, it deposits a white pulverulent matter, which is nothing else but uric acid. The supernatant liquor is slightly coloured, acid, and gives, on the addition of lime water, a precipitate which has the character of phosphate of lime.

acid and phosphate of lime. Some herbivorous birds have a large quantity of benzoic acid in the urinary secretion, and in such cases the proportion of uric acid, or urea, seems to be less.

The uric acid of aquatic birds resembles the gouano earth; and hence Fourcroy and Vauquelin are disposed to think that this peculiar substance has been formed from the excrement of these birds. From their experiments and observations upon the urine in various tribes of animals, they think that all classes of birds have this secretion very similar to that in the human subject; and they are disposed to view the difference that exists between the herbivorous quadrupeds and birds, with that of man, rather as the result of the different organization of the Kidneys, and other organs, than from the nature of the food.

The urine of several herbivorous animals is alkaline, when voided; whilst that of the human subject, when in health, is invariably acid. Carnivorous animals, also, void alkaline urine, as the lion and tiger. The urine of the beaver has a great similitude with the urine of herbivorous animals. We find carbonate of lime held in solution by a superabundance of carbonic acid, urea, benzoic and acetic acids, muriate of soda, sulphate of potash, but no free uric acid, or phosphoric salt. It differs, however, from them in containing no muriate of ammonia, but a notable quantity of carbonate and acetate of magnesia, which are not found, at least in any quantity, in the urine of herbivorous animals. It is tinged by the vegetable the animal has last fed on; thus a secretion examined by Vauquelin was tinged by the willow bark.

The urine in herbivorous animals is more turbid, and decomposes more readily than that of carnivorous animals.

It was imagined that none but carnivorous animals passed urea, or uric acid, in the urine, until Vauquelin announced its existence in a concretion found in the bladder of a tortoise, and, subsequently, convinced himself of its presence in the herbivorous animals. In the graminivorous animals, there is urea and hippuric acid; but this acid is only a different combination of the same elements which enter into uric acid, viz., carbon, hydrogen, nitrogen, and oxygen, there being more nitrogen in the latter acid than in hippuric acid.

It is a striking feature in the composition of the urine of various animals, that where urea is deficient, or small in quantity, as a distinct substance, there is a large supply of super-urate of ammonia. This is peculiarly the case in the beaver, an herbi-

vorous animal. In this beast, the urine contains free urea, but no ammonia. In the ostrich, there is no urea, but uric acid, and a salt of ammonia. So also with birds feeding on vegetable substances; whilst the Kidneys of carnivorous birds separate a large quantity of urea, and no ammonia. A similar result is noticed in the examination of the urine of amphibious animals, as serpents, lizards, &c. I notice this fact, because the absence of urea, which contains 46, and uric acid 40 per cent. of nitrogen, and the presence of the last acid with ammonia, throw light upon this otherwise obscure point.

If urea, as I shall show, be a SECRETION FROM OIL, and if oil contains no nitrogen, whence does the urea obtain its nitrogen? I reply from the decomposition of the ammonia of the ANIMAL OIL. Where there is excess of nitrogen in the economy, there we find the highest quantity in the urine; thus we have urea, uric and hippuric acids, and ammonia, in combination with these acids, in various degrees and gradations.

In the examination of the urine of carnivorous and herbivorous animals, VAUQUELIN states, that the substances not soluble in alcohol are sulphate and phosphate of lime, and an ANIMAL MATTER, which I look upon as a drain from the oil of the Kidney, and most probably the "ÉLAINE" principle of CHEVREUIL and BRACONNET. On the other hand, this able chemist detected in these urines a substance which alcohol dissolved, and which gave to it a red colour. The alcohol being evaporated, left a thick brown liquor, in which was some black oil. Water being then put with it, rendered it turbid, and separated a much larger quantity of oil, which had the aspect of black pitch[1]. In all probability, this latter substance will be found a draining from the "STEARINE" or SPERMACETI principle of Chevreuil, &c., in OIL and FAT.

The urine of the lion and tiger is perfectly similar in character, and has some analogy to that of the human subject. It differs from the latter, however, in containing no uric acid, and in almost the total absence of phosphate of lime; but it should be remembered, that this salt is soluble in water only, by the superabundance of acid; and the urine in question is always alkaline. The Kidneys of these animals do however separate a certain quantity of this salt; not from blood, as VAUQUELIN states, but according to my opinions FROM OIL, since oil contains

[1] Annales de Mus. d'Hist. Nat. ut supra.

lime, as well as iron and potash, in almost all animals; at least, in as many as have hitherto been submitted to chemical analysis. In the urine of the above-mentioned beasts, however, there is a large quantity of urea, phosphate of soda, and ammonia, sulphate of potash, a mucous matter, or, as it should be termed, AN OILY MATTER [1], and a trace of iron. If, then, iron and potash and lime be detected by one set of eminent chemists (as CHEVREUIL and BRACONNET) in the fat of animals, and another set of chemists equally as eminent (FOURCROY and VAUQUELIN,) detect the same substances in the urine of such beasts, does it not demonstrate to a certainty, that the one results from, and is a secretion from the other? And the fact is worthy of remark here also, that potash is much more discoverable in urine and in milk, than in blood [2].

It has been already stated, that the urine is alkaline in some animals; among these, we may class the horse, the ox, the camel, the cow, the rabbit, the lion, and the tiger. The deposition of carbonate of lime in the horse, and the rabbit, renders this secretion milky, when it is voided. In the cow and camel, the urine contains muriate of potash, sulphate of potash, &c., but no phosphoric acid. In the horse, if the animal has been much exercised, the urine is glairy, and oftentimes as thick as gum water. When the beast, on the other hand, is at grass, or shut up in the stable without much exercise, this secretion is clear [3]. But in all these conditions, it becomes milky soon after it is voided. The specific gravity of the horse's urine varies between 1·030 to 1·050. I have found that of the ox, from 1·040 to 1·050; sheep, 1·010 to 1·020; pigs, 1·026 to 1·034; man, 1·010 to 1·030.

Although chemists are silent upon the subject, yet, I have no doubt that the urine of all those females throughout creation that are giving suck to their young, contains much less lime and earthy matter than at other periods, when they are not so nourishing their offspring. We know that a wise and gracious God has endued milk with a most nutritious property, and in this nutrition,

[1] Vauquelin ut supra.

[2] Henry's Chem. If physiologists insist upon the secretion of urine being wholly from blood, how can they explain away this chemical fact, for the Kidneys certainly cannot generate potash, or any other substance not in the animal economy? They can only separate it, as sieves, when present in the body. If, therefore, the mass of blood, at one moment, contains, for example, 10 grains of potash, how can the Kidneys make 20 grains of potash in the secretion, which is, literally, near the fact, unless it be, as I assert, multiplied from OIL ALSO?

[3] Journal de Médecine, tom. xl. p. 460.

has conveyed lime as the element for the future formation of bone in the young. A chemist has beautifully shown the degrees of quantity of lime which the mother's milk contains during the gradual growth of her young ones. It is stated, that before the birth of the animal, the milk of the mother has but a scanty supply of lime and other earths; but as soon as the young are born, and commence sucking, the earthy matters, as lime, &c., appear in increasing quantities, and the increase per cent. continues, until the young ones are fully formed, each animal "after its kind [1]."

As milk is, as I shall hereafter show, wholly a SECRETION FROM OIL, the earthy matters, that, under ordinary circumstances, in the adult animal would be sent away by the urine, are, in the female, who gives suck, transferred to the milk, for the purpose of building up the bony fabric of her offspring. O the wisdom and goodness of GOD! there is no searching of His understanding! who hath known the mind of the LORD, or who hath been His counsellor?

The peculiar odour, colour, and general character of urine, depend on its urea and uric acid. I have already observed, that the burret fish owes its beautiful purple tint to the uric acid of its economy; and first in proportion as this substance pervades the urine, so will the secretion be heavy in specific weight, dark or amber-coloured, and give off its peculiar odour. But when the urine is extremely pale and copious, as during the hysterical paroxysm, or nervous distress and anxiety of mind, this secretion contains very little urea, or saline matters. The quantity voided during health in the human subject in 24 hours, should average from 40 to 46 ounces, or two and three quarters to three pints. It should be clear, and give off a decided odour peculiar to it; the colour of amber; of the specific gravity of 1·010 to 1·025, supposing water to be 1000.

As I shall have occasion to refer to this important subject, under the head of advice to persons, concerning the changes which the urine may be observed to undergo from indisposition, or other causes, I shall now leave it, merely remarking, that there is perhaps no secretion of the animal body so important, and so copious in a given time, as the secretion from the Kidneys; neither is there any fluid so liable to alter from day to day, in quality, quantity, and general character; and it often occurs, that a neglect in noticing, or attending to these early deviations from health, is succeeded by distressing symptoms of indigestion,

[1] Parke's Chemical Catechism.

disordered liver, and constipated bowels, or otherwise, a capricious state of action of these parts; they being sometimes relaxed, and at others, the very opposite, until at length disease, and altered structure of the Kidneys sets in, and the painful distress of general derangement of the system follows, which lays the patient on a bed of long-continued sickness.

On reviewing the ground travelled over, and taking a retrospective glance at the gradual steps which an Infinite Mind hath planted from the meanest vegetable to the meanest insect, and from it to the noble creature made after His own image; we stand amazed at the long line of beauty, symmetry, and order, which creation presents, and, adoring, we cry, O LORD, our Lord, how excellent is Thy name in all the earth! Who hast set Thy glory above the heavens. When we consider Thy heavens, the work of Thy fingers, the moon and the stars which Thou hast ordained, we can only exclaim with holy fervour, and ask, What, what indeed is man, loathsome and abominable in Thine holy eye, by reason of his iniquity, pride, and rebellion; what is he, that Thou, the eternal GOD, enthroned in light, which none can approach, art pleased to be mindful of him, and to visit him with mercies countless as the sand on the sea-shore!

Thou hast made all things in earth subservient to his comfort and enjoyment; and hast given him the dominion over the works of Thy hands, and hast put all things under his feet. All sheep and oxen, yea, and the beasts of the field, the fowl of the air, and the fish of the sea, and whatsoever passeth through the paths of the same.

And as though this were not enough to set forth Thy tenderness and compassion towards him, Thou gavest Thyself, and didst enter into covenant with man in Thy beloved SON, before all worlds, for life eternal; and though Thou art what Thou art, a holy, sin-hating and sin-avenging GOD, yet Thou didst choose in thy infinite condescension and mercy to show Thyself, in the light and power of GOD the HOLY GHOST, a just GOD, and yet a Saviour; justifying the ungodly in Him, who is GOD in our nature, and laying all our transgressions on His holy head, and sending them away to a land not inhabited, that Thou mightest be the justifier of Him that believeth on the incarnate God unto eternal life.

And when this noble being, man, is weighed in the balances of Thy just and holy law, what a puny, miserable, loathsome animal he is, beset full of disease, frailties, and infirmities in body and soul. The corruptible tenement of this once pure creature is

stained and polluted by his original taint, as a son of Adam; and sin, disease, death, and hell follow from the same spring of deadly water.

"For as by one man sin entered into the world, and death by sin, and so death passed upon all men, for that all have sinned; even so by the righteousness and obedience of one, the free gift came upon all men unto justification of life. So where sin abounded, grace did much more abound." Thus the pious yet quaint old writer says—

"LORD! what a nothing is this little span,
We call a MAN!
What fenny trash maintains the smoth'ring fires
Of his desires!
How slight, and short, are his resolves, at longest;
How weak, at strongest!

Oh! if a sinner, held by that fast hand,
Can hardly stand,
Good GOD! in what a desperate case are they,
That have no stay!
Man's state implies a necessary curse,
When not himself, he's mad; when most himself, he's worse."

QUARLE'S EMBLEMS, A.D. 1630.

PART III.

CHAPTER I.

ANATOMY; THE OIL-TUBES, &c.

Of all the wonderful and curiously constructed organs of the human economy, of all the powerful corporeal agents in the hand of the great Creator, as the maintainers of health, or the originators of disease in the human frame, there is not any which, in importance of function, delicacy of parts, or rapidity of action, is found to rank pre-eminent above the Kidney.

The Kidneys are two solid bodies, placed at the posterior part of the abdomen, behind the bowels, on each side of the lumbar vertebræ of the spine, and between the false or lower ribs, and the hip bones.

The right Kidney, as is well known, lies lower than the left in the human subject: whilst in all other animals, it lies higher than its fellow. It is also larger, fatter, and more compact in its whole texture than the left. The right is partly covered by the lower edge of the liver. The left is partly covered by the spleen. Each Kidney, when divested of its fat, &c., weighs nearly four ounces.

Their figure resembles a large kidney bean, and they present two surfaces. The posterior, which is flat, and larger than the anterior, which is rather convex. Their outer circumference is rounded, their inner circumference is concave. Their concave side looks inwardly towards the spine; their convex side outwardly towards the ribs. Their length answers to the distance that exists between the last rib, and the upper edge of the hip bone. They are about half as broad as they are long, and half as thick as they are broad: between the corporeal and the intellectual,—the humble feet and the commanding brain. Thus do they hold, as it were, a central place.

In each gland may be noticed an upper end, which is rather broader and more incurvated than the lower end. Within this curve is a depression or hollow which lodges the fat, the various vessels, ducts, nerves, lymphatics, &c. &c., passing to and from the organ.

The Kidneys are covered in their fore-part only by peritoneum, but are outside of this membrane. They are surrounded by a loose cellular covering, known as the adipose membrane, because in robust and healthy persons its cells are filled with oil. They have a proper coat or membrane, which envelops them as a skin. This membrane I shall term, at present, "THE REFLECTED MEMBRANE" of the Kidney.

The artery, supplying its life-giving blood to the Kidney, will be longest on the right side, and the vein the shortest, from the relative situation of the aorta and vena cava on each side of the spine, and vice versâ.

The veins lie more anteriorly than the arteries, both without and within the glands. The fat or oil surrounds both, without and within the organ; it surrounds the ureter only, without the Kidney, whilst it is enclosed in the various branches of this duct in the bosom, or interior of the gland.

The substance of each Kidney when cut into, or torn open, may be readily divided in two kinds: the outer, greyish, spongy mass, termed the vascular, or secreting substance; the inner, which is a red, tubulated mass, termed the medullary substance. The outer is uniform in consistence and appearance; but the inner is not so. I shall, therefore, subdivide it into three parts. The vascular portion which forms its circumference; the tubular portion, which forms its centre; and the papillary, which is the apex or point of termination of the other two. This view will be useful in the further description of the gland, and it is too apparent to escape our observation.

The vascular or secreting substance of the gland is a collection of innumerable arteries, veins, urinary ducts, and as I have already mentioned they are the parts by which the OIL-TUBES are connected together, to which I give the name of FLOCCULENT and FEATHERY[1].

[1] I here beg leave to refer my readers for a correct representation of these wonderful "FEATHERY OIL-TUBES" to the frontispiece, from very beautiful drawings from my preparations by George Foggo, Esq., wherein the nucleus of a Kidney is represented as well as a most interesting view of several urinary ducts of our great anatomists, to which are attached portions of bunches of "FEATHERY OIL-TUBES." The one can easily be distinguished from the other, by the colour, by the delicacy of the OIL-TUBES, and the flocculent appearance of the latter in contradistinction to the solid conformation of the well-known URINARY DUCTS.

The medullary, or excreting substance of the gland, is an assemblage of the above-described innumerable "FEATHERY OIL-TUBES," urinary ducts, with a few slender arterial and venous branches, not connected by any net-work of membrane.

The vascular substance not only surrounds the whole organ, but it passes within the spaces between each medullary mass, and fills them by prolongations of various lengths and thicknesses. By this means it separates the various portions of the "FEATHERY OIL-TUBES" and urinary ducts, and leaves them in distinct bundles.

Having given a brief outline of the general anatomy of the Kidney, I now intend to describe the remaining portions of the gland, and its minute structure, in the following order. First, the three membranes of the Kidney; the adipose membrane; the reflected membrane; and the reticulated membrane.

Secondly, the ureter; the pelvis with its oil, and its course without and within the gland.

Thirdly, "THE FLOCCULENT FEATHERY OIL-TUBES:" and, lastly, the urinary ducts; the veins; the arteries; the nerves; and the lymphatics.

CHAPTER II.

ANATOMY; THE OIL-TUBES, &c.

Of the adipose, or cellular membrane of the Kidney.

THE first universal integument of the body is the skin. The second, the adipose, or cellular membrane. It is not a single layer, but a series of membranes, joining irregularly to each other at different distances, so as to form numerous interstices of different capacities, which communicate one with another. The interstices are named cells; and their substance, cellular tissue. These cells are so many bags or satchels, filled with oil, more or

less liquid; and which we call fat in some animals, and oil in others, according to its density. The thickness of this cellular membrane varies with the different parts of the body, and is not the same all over it; this originating from its few, or many layers.

The different consistence of oil depends not only on the oily matter, but also upon the size, extent, and subdivision of its cells. The structure of this membrane is demonstrated by butchers, when they inflate the adipose membrane, and the air not only enters these cells, but pervades the fibres of muscles, and even the viscera. The proportions in thickness of this membrane are wisely and beautifully adjusted for use and symmetry, wherever they seem requisite. We find the membrane rounding the muscles, padding the bones, muscles, and skin, and giving that elegant and noble embonpoint which is the token of vigour and health. It is not only placed between muscles, but between each minute fibre of a muscle, and between the skin; surrounding their tendons in form of sheaths, and accompanying the origins and insertions of every muscle in the body. Where the muscular action is most powerful and frequent, there we find a thicker or fatter layer of this adipose membrane. Thus the loins, buttocks, legs, and arms. But where the muscles are very small, as in the larynx, face, and eyelids, they are furnished with a lesser quantity, and that of the most delicate nature. In some parts it is braced down by a contraction in form of a fold; thus, in the fold which separates the base of the chin from the neck, and the buttocks from the thigh. These peculiarities never change, under any circumstances, because they are natural, and depend on the peculiar formation of the cellular membrane in having no layers. It also expands itself upon the periosteum of bones, ligaments of joints, which it surrounds, and, as I believe, forms the continued membrane of the interior of the joint, known as the synovial membrane. It insinuates itself under the lobes of the brain, upon the pleura, and the peritoneum, &c. What, therefore, the oil is to joints, so also is this oleaginous tissue to the muscles, and the various parts into which it insinuates itself.

"This membrane, therefore, from the incredible expansion of its cells with each other, carries on an intercourse between parts of the body the most remote from each other; between the skin, for example, and the marrow of the bones; for as it reaches from the skin to the external periosteum, and as the matter which forms the marrow is conveyed to the bone, and a portion of it

reconveyed back again by the vessels of the periosteum, the way is obvious how these remote parts may communicate [1]."

Boerrhave was convinced of this structure, and these uses of the cellular or adipose membrane, by experiments which he made; and he considers that the knowledge of it is most essential in the treatment of surgical cases.

Cheselden says, "that the cells of this membrane communicate throughout the whole body; so much so, that from any one part the whole body may be filled with air [2]."

The adipose membrane surrounding the Kidneys is only a continuation and greater expanse of that peculiar tissue which pervades the whole body.

It forms here, as elsewhere, innumerable cells, in which the oil is lodged. These cells may be dilated to a very great size by inflation; and are usually distended with oil in fat persons and beasts. On the other hand, a lingering disease, as consumption, will remove all traces of their existence in many parts of the body. Air, as in emphysema, or water, as in dropsy, will distend them to an enormous size.

That dense mass of oil shut up in its numerous cells above, and around the Kidney, I purpose calling "THE LOG OF OIL," after the language used by God the Holy Ghost in His Word in describing the various offerings for the Jewish people. This "log of oil," therefore, is a series of cells, all communicating one with another, and containing a large quantity of oil when warm, or suet, as we term it, when cold. The cells that are farthest from the Kidney are the largest, and the most dense of the whole "log." As the oil drops from cell to cell, it passes through partitions thinner and thinner, or sieves finer and finer, until the net-work is so delicate, around and within the gland, that it requires a magnifying power to demonstrate it. The adipose membrane surrounds the great vessels, and the ureter, to their entry into the Kidneys, but does not accompany them any farther. The oil corresponds, likewise, in its consistence to the circumference of the cells which contain it. If a small portion of oil is taken out of the adipose membrane most remote from the Kidney, and smeared over the hand, it runs lumpy and hard over the warm skin. If a portion, however, be removed from the minute cells, just as it is entering into the bosom of the Kidney, and similarly treated, it runs over the hand like tallow taken from

[1] Winslow's Anatomy. [2] Cheselden's Anatomy.

under the flame of a candle. If the grosser lumps be taken, again, and held over a spirit lamp, it spurtles, and burns with a crackling noise, as though it contained water and salt. But, on the contrary, a portion from the bosom of the Kidney burns silently, rapidly, and is truly PURE OIL.

The liquefied oil of a beast thus treated drops in crystalline and semi-transparent globules, on paper, as white as the finest tallow. In the human subject, when obtained as near the standard of health as sudden death and disease permit us to collect it, the oil has a citrine-coloured tint; but it approaches nearer to white tallow, when removed from the interior of the Kidney, and treated as above described. As I shall have occasion to speak more fully of animal oil hereafter, I must now dismiss this part of my subject, and proceed to the consideration of the remaining membranes of the Kidney.

Of the proper, or reflected membrane of the Kidney.

This membrane is not cellular, like the adipose membrane. It envelops the whole substance of the Kidney, like a skin, and lies close upon its flesh. It passes into the bosom of the gland, being reflected within itself, as I shall presently describe. It is immediately beneath the adipose membrane, but I am inclined to think that it has a communication with it by means of oil-ducts and vessels on the external portion of the Kidney. It consists of two delicate layers; the outer one being more dense and fibrous than the inner one. Between these two layers is a delicately and most minute wrought net-work, of cellular tissue. Air, blown between these two layers, distends the cells of the tissue, and exhibits the two coats of this membrane. At the mouth of the Kidney the membrane is reflected inwardly, lying upon or on the outside of the suet, the pelvis, and blood-vessels; so that these latter pass into the gland between the reflections of the membrane just as the finger passes into a glove. Within the Kidney these two layers are not so manifest, and the outer one is lost at the broad part of the pelvis, and just within the mouth of the gland. This membrane is not vascular, and is extremely thin. It is probably nourished by minute TUBES conveying OIL coming off from the adipose membrane. It appears smooth and shining when wetted with water. If the animal is healthy it strips off with perfect ease, and causes a distinct crackling as it is torn

away from the flesh. This circumstance is not noticed in some diseases of the gland, for the membrane then comes away, as though it were only stuck on by a thin layer of water or gum.

There is always some firm oil adhering to this membrane in healthy animals, which is not easily torn away without injury to the membrane itself. In the fœtal Kidney of the human subject, and in the ox, &c., the membrane dips down into the various fissures which are seen on the surface. It forms a sheath to any vessel going into, or coming out of, the surface of the gland.

The reflected membrane having surrounded the Kidney passes to its mouth, and lies on each side of the pelvis, to which it now becomes intimately united. So intimate is this union, that in describing the course of this membrane, I am, in fact, also describing the course of the pelvis with its seven branches, the calyces and their branches; for the membrane forms sheaths to them all, and passes inwards and upwards to the very surface of the gland, and surrounds all the large vessels, as soon as they emerge from the seven branches of the pelvis. It thus forms a space through which the ureter, veins, and arteries, &c., pass. The further course of this membrane through the Kidney may be represented by the hand and fingers when covered with a glove. The hand is figurative of the mass of vessels, ducts, and nerves; the palm, of the pelvis; the fingers, of the several branches of the pelvis; and the whole glove, the course of the membrane over them. If the thumb of the glove be turned outside in, it will represent the ureter passing out from the pelvis; whilst the palm of the half-closed hand, with its glove on, will be figurative of the interior of the pelvis. If, therefore, a lady's long glove be put on the hand, and the portion usually covering the arm be drawn inside out over the hand and fingers, it will just represent the whole course of this reflected membrane. The flesh of the Kidney may be represented as between the inverted portion of the glove and the fingers and hand. It resembles, therefore, a double-headed nightcap, having the flesh of the gland, as it were, between the two heads of the nightcap. And here I must leave its description for the present. The importance of this membrane, and the necessity of having an accurate knowledge of its course, will be seen when I proceed to the consideration of the manner in which the oil is distributed through the seven divisions or branches of the pelvis.

Of the reticulated membrane of the Kidney.

Having stripped off the reflected membrane from the surface of the gland, we may notice, that the gland is still shining and glossy. This feature arises from what I shall term the "RETICULATED MEMBRANE," which is now seen.

This membrane is far more delicate than the preceding one. It differs from it, also, in being reticulated, like a net. It is so closely adherent to the outer, or reflected membrane, that we might consider it as an internal layer of this membrane. But, as its name implies, the character of it differs from the former, as does its office. It penetrates the substance of the Kidney in every part by numerous prolongations, and it cannot be torn away from the gland without dragging away the flesh with it. The pia mater of the brain bears a resemblance to it in many of its characters.

Like this membrane, it is the medium by which the vessels are continued through the organ; and, therefore, in injected Kidneys it seems to be made up of innumerable minute vessels. Under the microscope, this membrane, at the surface, and the net-work within the gland, are precisely similar; they are one continuation; and, as I have before remarked, it might be considered as a continuation of the inner layer of the reflected membrane, rather than as a separate membrane.

This membrane is more minutely injected from the arteries than from the veins. It enters within all parts of the vascular substance, but is not found in the medullary portion of the gland.

CHAPTER III.

ANATOMY; THE OIL-TUBES, &c.

Of the ureter and pelvis; and of the course of the oil within its various branches.

In order to give the reader a true conception of the course of the ureter, and of its relative position with the other parts of the

Kidney, I shall again use the simile of the hand covered by a glove, with the thumb turned outside inwards, and the glove having seven fingers instead of four. This will represent the seven branches of the pelvis. The ureter, having waded through the mass of fat which is going into the Kidney, passes into the free and open space of the pelvis at a spot that is opposite to one-third of the distance of the whole breadth of the gland. This spot may be represented by the open mouth of the thumb of the glove, when the thumb is turned outside in. The body of the glove covering the palm is, therefore, the whole pelvis, which encloses the oil, arteries, and veins, &c. &c., just as the glove encloses the palm of the hand. The breadth of the pelvis is rather more than half the breadth of the whole Kidney. There are usually seven divisions, or branches, coming off from this portion, termed the pelvis; and these portions have received the name of calyces, and they may be represented as the seven fingers of the glove, enclosing oil, veins and arteries, nerves, lymphatics, &c. &c. But I shall term them the "seven 'SEMICIRCULAR OIL-TUBES' of the Kidney." From these seven principal oil-tubes come off other smaller ones, but still are they, also, "semicircular oil-tubes." These smaller ones may, perhaps, vary from 80 to 100 in number. They pass in semicircular forms to the seven principal oil-tubes, and in the human subject, and ox, form the most complete net, so that in the living body they must be arranged like so many cabbage-nets. Through the interstices of this net pass the several prolongations of the medullary substance before terminating in papillæ.

From the whole series of these large and small "semicircular oil-tubes" come off an innumerable set of tubes, shaped with "barbs and barbules[1]," like a feather; I shall, therefore, term these "THE FLOCCULENT FEATHERY OIL-TUBES" of the Kidney. They may be described as coming off from the ends of the seven fingers of the glove, and as hanging about like so much down, or shaggy substance, when properly prepared for demonstration. They are dispersed throughout the whole medullary and vascular substance of the gland, and compose, at least, three-fifths of the bulk of the organ. They may be traced to within one quarter of an inch of the surface of the Kidney, where they are lost in minute terminations.

The reflected membrane cannot be traced with the naked eye

[1] See J. Hunter's description of a feather. Cat. of Royal Col. of Surgeons, vol. iv.

beyond the "semicircular oil-tubes," though, from microscopic observations, I have no doubt but that it is continued as a delicate covering to these minute "feathery oil-tubes" throughout their whole course, and passes with these tubes into the urinary ducts, thus forming a continuity of surface between the external parts of the tubes and the internal surfaces of the urinary ducts, as will be seen presently.

From that portion of the pelvis, which corresponds in a glove to its several seams [1], or edges of the pelvis, come off, besides the above-described feathery oil-tubes, an innumerable set of the same kind of tubes, but which, for distinction's sake, I shall term "THE LATERAL FEATHERY OIL-TUBES." They are not so numerous as the first-mentioned tubes, but their office is the same. The whole series of feathery oil-tubes might be justly represented by sticking in the ends of the fingers of a glove a large bunch of white small downy feathers, and by putting some, also, along the various seams of the glove, it would give a pretty fair representation of the "lateral feathery oil-tubes."

The oil or suet of the Kidney, having arrived at the mouth of the gland, is placed between the two layers of the reflected membrane, as this, hitherto, external covering passes inwards to become again an external covering to the pelvis, the semicircular oil-tubes, and the feathery oil-tubes. The oil encircles the ureter, veins, and arteries, &c.; but when it arrives at the seven semicircular oil-tubes, it passes into them, as seven fingers would pass into a glove; the reflected membrane and the tissue forming the tubes then lying around it.

When the oil arrives within the semicircular oil-tubes it performs a most important office with the veins, as I shall notice when describing these vessels. The oil becomes more and more delicate in colour and consistence, when within these semicircular oil-tubes, and its thicker particles are now no longer noticed, as in the oil remote from the Kidney. The cellular membrane, enclosing this oil within the semicircular oil-tubes, is exquisitely delicate and downy.

As the oil passes around the course of the ureter, it insinuates itself into the numerous orifices [2] of this duct, and thus performs the important office of lubrication to the ureter. Hence we constantly see a mass of suet surrounding the ureter for three or five

[1] Both the seams in the palm of the hand, as well as along the various seams of the fingers, are here meant.

[2] Anatomically known by the term "lacunæ."

inches after it has quitted the Kidney; and in very fat persons, and in well-fed beasts, it encircles this duct in its whole course, until it dips between the coats of the bladder, and is lost.

If the kidney of a sheep be sliced open, the oil is observed to reach as far as the upper circumferences of the semicircular oil-tubes. We might hastily conclude that its progress stops here. But such is by no means the fact. The oil passes out of these semicircular oil-tubes into the innumerable mass of feathery oil-tubes. When examined within these latter tubes it is found to have lost its cellular membrane, and is purely a liquid oil, no longer in cells. Its only covering here is the surrounding substance which composes the tube, and which is a delicate prolongation of the substance composing the semicircular oil-tubes. The oil, having now passed into the true feathery oil-tubes, is continued on in these tubes to their termination; and here I must leave the further consideration of the oil, in order to describe their office in the connection which these feathery oil-tubes have with the urinary ducts in the Kidney.

CHAPTER IV.

ANATOMY; THE OIL-TUBES, &c.

Of the flocculent feathery oil-tubes[1].

In referring to the various opinions of ancient and modern writers upon the Kidney, contained in the first part of this work, it must be apparent, that the most extraordinary discrepancy of opinion existed, and still exists, concerning the anatomy of this remarkable gland. I believe one cause, and perhaps the chief one also, of this variance arose from this circumstance; that

[1] Or the "veins," probably, of Carpi and Matthæus de Gradi; the second class of ducts, or "glandular ducts," of Bertin; the "mèches" of Mr. Winslow; the "vaisseaux spongieuses" de Vieussens; the "ducts from veins" of Eysenhardt; the "white cortical ducts" of Ferrein; and the "serpentine ducts" of Müller, Ruysch, and Meckel, &c.; the "lymphatic vessels" of Nuck, &c.

many anatomists had successfully injected the urinary ducts from the ureter to the very surface of the gland, and yet still found a WHITE MATTER, or, as some termed it, a series of ducts, not injected. Such was Bertin and Ferrein's case in the prosecution of their researches. But they hastily concluded, that these ducts were also urinary ducts. They thought them to differ from these latter in size, but they never looked upon them as a distinct and important set of ducts, having an office altogether different from the true urinary ducts, though answering ultimately the same end, by purifying the solids and fluids of the animal economy. Hence their labours were profitless; for none of these anatomists throw the least light upon the uses of the non-injected ducts. Bertin thinks one set (the urinary) came off from blood-vessels, and the other set (the white ducts) from glands. Ferrein does not offer any novel opinion upon their office; but he ranks them with the true urinary ducts, and says they are for secretion also. Indeed I must confess that it surprises me when I read Ferrein's researches upon the Kidney, and find him describing so accurately a second set of ducts which he found to differ from the true urinary ducts, and yet that he should never have suspected their true office. As to their origin, he differs from his contemporary Bertin, because he maintains that they come off from blood-vessels. Neither does he attempt to explain the cause of their non-injected state when the Kidney has been injected by the ureter, arteries, and veins. This fact alone, I think, will convince every mind that Ferrein did not know either their true origin or their office, otherwise his surprise at not being able to inject them must instantly have ceased. It is true, as I have just remarked, that Ferrein thought these white ducts came off from blood-vessels, yet it is surprising that he should adhere to this opinion after the repeated failures he met with in attempting to inject them from blood-vessels. This eminent man, moreover, is incorrect in his description of these "white ducts." He asserts that they take their origin from the surface of the Kidney, and continue to increase in number until they make up the conical mass known as the pyramids of Ferrein. I have already described them passing into the vascular substance of the Kidney, and ceasing within one-fourth of an inch from the surface of the gland. What these white points were on the surface, described by Ferrein, I shall presently show: they did not, however, belong to his "white ducts," or, as I term them, throughout this work, "the feathery oil-tubes."

I now proceed to the description of the true office of these feathery oil-tubes. It is to pour out the excrementitious drain from the log of oil around and within the Kidney. But in all new discoveries, or theories, the professional body, as well as the public in general, are more or less startled, or, perhaps, shocked at the novelties laid before them. The circulation of the blood, when broached by Harvey,—transmitting the lymph of a diseased cow into the human subject as a preventative to a fearful and often fatal malady, by Jenner,—created an overwhelming sensation in every thinking mind. That urine should now be discovered and pronounced to be a secretion or drain from animal oil, will, perhaps, at first, be received with something of a like sensation. But the reader is here presented with two or three facts, that he may pause before any judgment is pronounced.

First, That the tallow-makers out of two hundred gallons of melted fat draw off upwards of nine gallons of water.

Secondly, That according to the chemical researches of those eminent men, Chevreuil and Braconnet, animal fat consists of a spermaceti-like crystallizable substance, of oil, ammonia, potash, lime, and iron, which very substances are found, under certain modifications, in the urine.

Thirdly, That the purified oil within the bosom of the Kidney, is found to have spent its watery and saline particles, and consequently burns silently; whilst that remote from the Kidney, which has not undergone such purification, spits and spurtles in the flame, thereby showing its admixture with salt and water.

But to return. With regard to the shape of these flocculent feathery oil-tubes, they are similar to a very fine feather, with its barbs and barbules. The barb of these feathery oil-tubes lies upon an urinary duct, or between two of these ducts, as they descend from the surface of the gland. They thus become intimately bound up with the little bundles of urinary ducts. The barbules of these feathery tubes penetrate the sides of the urinary ducts, and empty the excrementitious drain from the oil into these ducts. They cannot be injected from the urinary ducts, nor from the veins or arteries, for they have no connection with the blood vessels.

The barbules are very minute, and pass into the urinary ducts in a valvular mode, such as the ureter forms in its entrance into the inner coat of the bladder, so that injection will not go into them from the urinary ducts. These tubes throughout their whole course are surrounded by a most delicate, shaggy, or

downy membrane, which is reticulated, and has the appearance of minute hoar-frost; but under the microscope it resembles fine lamb's wool, or white moss.

The majority of these feathery oil-tubes pass into the urinary ducts, in the vascular substance of the gland. But those which I designated the lateral feathery oil-tubes, join the urinary ducts, in the medullary substance. I believe that these lateral oil-tubes, from their relative position, pour out an oleaginous fluid, less watery in its character than that which is drained away from the other feathery oil-tubes in the vascular substance. The use of this oleaginous fluid, I apprehend, is simply to lubricate the internal surface of the pelvis in the same manner that the ureter is lubricated by that oil, outside of the pelvis and Kidney, which passes into the orifices[1] of this duct[2].

As the feathery oil-tubes arrange themselves along the sides, or upon the urinary ducts, they form very minute spaces, in which spaces pass the delicate blood-vessels of the Kidney. I am convinced, however, that the coats of these oil-tubes derive more nourishment from the oil within them, than from arterial blood without them. In the same manner that a goose's quill is nourished in its barbs and barbules by the fine oil which passes up the pith or fine membrane within the quill. It answers in the quill to the fine marrow in a bone.

Hence the central portion of the medullary substance of the Kidney is always paler than the circumference of the cones. This appearance arises, first, from the presence of the lateral feathery oil-tubes; and, secondly, from this circumstance, that as the oil-tubes and urinary ducts centralize themselves in the cones, they leave scarcely any space for blood-vessels, so that they are merely white oil-tubes and urinary ducts, without blood-vessels.

I must now conclude this portion of the anatomy of the Kidney, by a brief description of the ureter. This duct is composed of three coats, the whole being surrounded by the adipose mem-

[1] Lacunæ.

[2] Eysenhardt, in speaking of the medullary substance of the Kidney, observes that in this substance, he found numerous vessels not joined, but simple, going in a straight direction, and communicating apparently with the cones of Verheyen; but he remarks, "I could neither ascertain this communication, nor see the beginning or ending of these vessels."—Mappe's Journal Complém. des Sciences Médicales, t. xii. p. 223.

I doubt not but that this anatomist saw the lateral feathery oil-tubes, and mistook them for vessels.

brane, which, as I have remarked, is usually loaded with oil throughout the greater part of its course to the bladder. The outer coat is white, and of a dense texture; the middle one is more vascular and fibrous, in which the fibres intersect each other. The internal coat is very delicate, and consists of a reticulated net-work of vessels; it is granulated like shorn velvet, and moistened with an oleaginous liquid throughout its course. This is a secretion or drain from the surrounding oil in the adipose membrane. Thus the whole canal is preserved from the acrimony of the deleterious fluid which passes down, and it is supplied by oil in much the same way, and for the same purpose, as the pelvis is furnished with lubricating oil, from the lateral feathery oil-tubes. At the margins of the semicircular oil-tubes, the internal membrane of the ureter and pelvis is blended with the reflected membrane of the Kidney, thus establishing a membranous continuity of surface between the external and internal portions of this gland.

CHAPTER V.

ANATOMY; THE OIL-TUBES, &c.

Of the urinary ducts.

THAT portion of the Kidney which is popularly known as the flesh of this organ, is made up of an innumerable collection of urinary ducts, blood-vessels, and the terminations of the feathery oil-tubes connected together by the delicate reticulated membrane. The origin of each duct commences within the venous circle at the surface of the gland, and terminates at the papillæ. If the Kidney of a subject who has died suddenly whilst in good health, or that of a healthy sheep, be injected from the veins with red size, and then sliced open, we may notice a peculiar dark red zone on the whole surface of the gland, about one-fourth or one-sixth of an inch in depth. The injection appears to have run

more minutely in this part than elsewhere. When sliced and viewed under the microscope, such is seen to be the fact.

This appearance, then, arises from a series of minute vessels which are injected. These vessels are an innumerable set of hair-like shoots from the renal vein, when it reaches the surface of the gland. If another healthy Kidney be also injected by the veins, and the reflected membrane stripped off, and a thin slice of the gland taken from the surface, and then dried on clear glass, we may notice, that within the circular spaces which the vein forms at the surface of the organ, there is a set of white, or whitish grey points, larger than the Malpighian cryptæ bodies on the arteries. Each circular venous space encloses one of these points. These points then are, the blunt ends, or more properly, origins of the urinary ducts. They are those white portions which Ferrein mistook for the origins of the white ducts, of which he speaks. But I have already observed, that these oil-tubes do not reach the surface of the glands, but are lost at some distance from the surface. This anatomist, I have no doubt, thought that the origin of his white ducts and the urinary ducts were from the same spot; and hence he has confused the two sets in many parts of his anatomical description, and left us perplexed and uncertain whether he really knew that there was any difference between the two sets.

Müller is the first anatomist who has accurately demonstrated the obtuse or blunted origins of the urinary ducts at the surface of the gland [1].

If another slice of a Kidney, injected as before, be removed from the surface, and well washed in water for some time, the cellular or reticulated membrane will be destroyed, and the connection between the venous circles, and the blunt origins of the urinary ducts, can be readily exhibited.

The various bundles of urinary ducts may be easily separated when immersed in a fluid. If a portion of the Kidney be torn away, so as to include the whole extent of these ducts from the papillæ to the surface, and if a needle is then passed between each minute bundle, we shall find that the reticulated structure of blood-vessels, which forms the union between these ducts at the surface, and the veins, does not allow the respective origins of these ducts to be separated, with that facility with which the continued portions of them unravel; nor can they even be broken through without tearing away, at the same time, the extremities

[1] Müller, De Penit. Struct. Glandul.

of these ducts, and some of their fleshy substance with them. It is on this account that a complete separation, or unravelling of the urinary ducts through their whole course, becomes a most tedious, and, nearly always, a most imperfect process for their entire exhibition. But it at once manifests the intimate union that exists between the venous circles on the surface, and the origins of the urinary ducts.

The origins, therefore, of the urinary ducts, take place within these venous circles, and they are joined to the veins by minute twigs from these vessels, the whole being connected together by the reticulated membrane. These venous circles, and their innumerable twigs, are the vessels injected, which give the peculiar dark zone to the Kidney when sliced open.

These blunted origins of the urinary ducts on the surface of the gland, receive a delicate prolongation of the internal layer of the reflected membrane of the Kidney, which dips down within each venous circle to pass into the duct, and there communicates, and is continuous with, the internal lining of the ducts, pelvis, and ureter.

Thus, the internal layer of the reflected membrane, and the internal lining of the urinary ducts are continuous. This continuity of surface takes place at the blunt origins of these ducts, on the external portion of the gland. So also, the external layer of the reflected membrane, and the internal lining of the ureter, pelvis, semicircular oil-tubes, and feathery oil-tubes, are continuous. This continuity of surface takes place at the margins of the semicircular oil-tubes, and along the feathery oil-tubes within the gland.

The numerous urinary ducts having passed out from the venous circles, run down like the rays from the circumference of a circle to its centre, converging towards the semicircular oil-tubes, within which spaces they pass to their points of termination, the papillæ. Just before they reach the semicircular oil-tubes, their spongy friable character disappears, and they become dense, fibrous, and hard. This change of character in the urinary ducts arises from two circumstances. They become more and more compact, and are girt together within as small a space as possible, to allow them to pass through their respective semicircular oil-tubes. They are also bound firmly round by the dense band of substance which composes every semicircular oil-tube.

But besides this peculiarity in the structure of the urinary ducts in this portion of the gland, they are now joined by the innu-

merable barbs and barbules of the feathery oil-tubes. The spot where this junction commences may be stated to be midway between the semicircular oil-tubes, and the surface of the Kidney. As the urinary ducts proceed downwards, they are again and again joined by numerous other oil-tubes, until the mass arrives within a minute distance of the semicircular oil-tubes; when a very scanty supply is sent off to the ducts, and the whole collection or assemblage passes between its respective semicircular oil-tubes, and assumes that appearance known as the medullary or tubular structure of the gland. The urinary ducts in their course downwards, run into one another, so that twelve or fifteen ducts are folded up into two or three at the medullary substance[1]. But that bifurcation, which some authors have spoken of in the urinary ducts, is an erroneous supposition; the mistake has originated with them in looking upon the innumerable feathery oil-tubes which join the urinary ducts, as so many urinary ducts also. These ducts are of the same diameter, and of the same admeasurement throughout; they could not therefore bifurcate without suffering a diminution in diameter[2].

It is not therefore a bifurcation of the urinary duct, but the adjunction or falling in of an oil-tube with a duct, which renders it forked. Hence, there is no appreciable difference between the diameter of a duct before the oil-tube pierces and enters it, than after this adjunction takes place. If it really was a bifurcation, as Müller's description implies, then the numerous branches into which the duct splits would render this duct twelve times larger in diameter at the medullary portion than in the vascular substance, which is wholly opposed to the fact. If ten thousand capillary vessels join into one, and form a single vessel, the diameter of that vessel must be in proportion to the collected diameter of the whole ten thousand. This rule holds good in the vascular and in the glandular system.

The urinary ducts are accompanied by minute twigs of arteries and veins in their course through the vascular substance, but a scanty supply passes along them in the medullary substance. The arteries with their cryptæ, or pellets, lie upon the coats of the ducts, and the vein accompanies them. The artery merely nourishes the coats of these ducts, and the pellets or Malpighian bodies, so erroneously termed glands, by Malpighi, Bertin, and

[1] Vide Appendix, No. 21.

[2] " Iterum iterumque ad corticem usque bifurcantur,
Eadem diametro qua ductus serpentini."—Müller, ibid.

others, have no connection whatever with the urinary ducts. These bodies perform no office in the secretion of urine. The artery is merely a nutrient vessel, and nothing else. It answers in all its characters to the hepatic or nutrient artery of the liver.

CHAPTER VI.

ANATOMY; THE OIL-TUBES, &c.

Of the veins of the Kidney.

THE origins of the renal vein are to be seen on the whole surface of this gland, when the principal trunk has been successfully injected with red size. These origins are minute vessels, running in circles, or forming oval spaces. Within these circles are seen the obtuse commencements of the urinary ducts. The dried slices from the surface of a Kidney so injected exactly resemble a minute honeycomb or net.

The artery, having ramified throughout the gland, and given it nourishment, then forms the arterial pellets, and expends itself towards the surface in the hair-like vessels of the reticulated membrane. These minute vessels pass into the circular veins of the surface, joining the vein at the circumference of its nets. The whole of these hair-like vessels, which form the medium of communication between the artery and vein, are injected in a successful injection of the renal vein, as well as those venous twigs which form the medium of communication between the circular veins and the origins of the urinary ducts. This is a further explanation of the red zone around the surface of a well-injected Kidney. The veins, having arranged themselves in this reticulated manner on the surface, pour out some of the constituents of URINE FROM VENOUS BLOOD into the urinary ducts. Having performed this important office, each vein of the circle, or single mesh of the net, falls into a straight vein, which runs inwards

towards the centre of the gland. When the veins arrive at the spot where the feathery oil-tubes form an adjunction with the urinary ducts, each of the vessels lies between two feathery oil-tubes, and passes into the semicircular oil-tubes, and then becomes buried in the delicate oil enclosed within these semicircular oil-tubes. Here the oil becomes intimately adherent to the coat of the vein. Here, also, the vein is found to be furnished with a more delicate coat than it had when ramifying within the vascular substance of the gland. This peculiarity of character answers a most important end. The oil having sent off its redundant and excrementitious ingredients to the feathery oil-tubes is purified. It then exudes through these veins into the mass of venous blood which is going downwards towards the vena cava, and thus passes into the general circulation. This admixture of OIL WITH VENOUS BLOOD, as it is going direct to the heart, takes place, as I believe, wholly on the internal surface of the gland[1].

For if the oil within the semicircular oil-tubes be carefully removed from the circumference of the renal veins, and the coat of these vessels examined, we shall find that the coat of the vein is more delicate in texture, much thinner, and adheres with remarkable tenacity to the adjoining oil. But the external area of the vein[2] is firmer and thicker in texture. The reason of it is this. The reflected membrane sends a process upward, which lines the outer surface of all the veins of the medullary substance, but does not line the inner area of these vessels. We, therefore, never see any suet or oil, visible to the naked eye, beyond the semicircular oil-tubes, for the reasons now stated. The excrementitious portions having been drained off into the feathery oil-tubes, which tubes come off from the semicircular oil-tubes, the oil, having then been purified, passes into the mass of circulating blood by means of those veins that are in the semicircular oil-tubes.

But it constantly happens, at least in almost all the Kidneys which I have examined, that just as the renal veins are forming themselves into one or two main trunks, they are joined by one or more white transparent oil-tubes, emerging from the log of oil around the Kidney. These convey oil, also,

[1] "Internal surface" here means that surface that is nearest to the centre of the pelvis, or opening of the ureter.

[2] The "external area" here means, that surface that is nearest to the lateral feathery oil-tubes and flesh of the gland.

to the blood passing to the heart. In sheep they are as large as a goose's quill. They terminate in the vein with a valve. No injection passes into these tubes from the vein. They may, certainly, be injected from the adipose arteries, but even this is done with much difficulty.

The seven semicircular oil-tubes usually enclose one vein each; so that these seven divisions of the vein pass out of the seven oil-tubes, and immediately unite themselves into two or more main trunks, which pass outwardly as far as the external margins of the gland, when they unite into one trunk, and form the renal vein which joins the vena cava.

From the preceding anatomical description of the oil-tubes, ducts, and veins of the Kidney, it will be seen, that the physiology of this gland exactly corresponds with my view of that of the liver. There are but a few slight shades of difference between them. Portal blood, from which bile is separated, is blood into the composition of which, oil largely enters. This oil is derived from the caul, the mesentery, the intestines, and even, as I doubt not, from the food itself. The portal blood is a fluid wholly for the secretion of bile, as Mr. KIERNAN most ably demonstrates in his valuable paper on the anatomy and physiology of the liver [1]. The hepatic artery is exclusively a nutrient artery, and the hepatic vein receives both arterial and portal blood.

The Kidney, however, has its own distinct departments for the offices of secretion from oil and secretion from blood. The feathery oil-tubes pour out their drain, and the veins pour out, also, their excrementitious matter, and the whole fluid conjointly forms the secretion which we term urine. The artery is a nutrient vessel only to the gland.

[1] Phil. Trans. 1833.

CHAPTER VII.

ANATOMY; THE OIL-TUBES, &c.

Of the artery of the Kidney.

The renal artery comes off from the aorta. It is two-thirds less in calibre than the vein. It passes into the gland with the vein through the fat which lies at its mouth. It soon divides into several branches. The earliest branches are given off to the pelvis and semicircular oil-tubes. These are very few and minute. The artery then divides, as the vein, into seven branches, and passes within each division of the semicircular oil-tubes. By this means the arteries are arched, or crescentic. From these arches they send off slender twigs to the cones of the medullary substance, and pass out of the arches into the vascular substance of the gland. They divide and subdivide up to the surface of the gland, where they terminate in hair-like vessels, and thus communicate with the circular origins of the renal vein. Some of the superficial arteries form stars, or rays, before they terminate; others pass through the reflected membrane, and communicate freely, with the adipose vessels of the "log of oil." The arteries do not hang about in loops or nets on the surface, as do the veins, but they curl upon themselves, and form the little pellets, known as the cryptæ or Malpighian bodies.

The renal artery has scarcely any anastomosing branches between each twig, whilst the vein is a series of anastomoses throughout the gland.

But the peculiarity of the renal artery consists in the fact, that it is the only vessel throughout the whole of animal structure that terminates in globular pellets. An injected artery therefore has an exact resemblance to a bunch of currants. I have already referred to the conflicting opinions of all writers upon this conformation. At these pellets, the artery ceases. The net-work, which is injected from the artery, is a series of hair-like vessels that carry the blood into the veins.

These pellets lie about the net-work; and one minute thread is all that can be traced, passing into each one. They consist, according to Tiedeman and Müller, of an external coat which is membranous, and an internal globule, which is a convolution of very delicate arteries; but Müller adds that the globules contain also "other matter," "adhering to them in one point. I think, however," he continues, "that I have observed the artery, which comes near the globule, divide like a lock of hair or skein, and twisted vessels arise from them, which are firmly connected with each other by a net-work of fastenings, and then run back again [1]."

Bertin justly notices a difficulty here also. "No communication is yet found between these bodies and the vein; if, therefore, they are minute twigs of an artery, how do they pass into their corresponding vein [2]?"

Meckel makes a similar remark. "I confess, that, contrary to Müller's opinion, I can rarely succeed in injecting them from veins; and when I have succeeded, I have had my doubts whether I did not use too great a force [3]."

To my mind, the office of these bodies appears but one. They are oil receptacles for the nourishment of the Kidney.

The "OTHER MATTER" of Müller, I feel assured, must be OIL, also destined for the nourishment of the whole gland. This oil is poured out from the delicate and convoluted vessels of the globule. Having accomplished this office these cease.

The globules are sometimes bloody in the fresh Kidney, but this appearance arises from extravasation of blood by over-fatigue, or from disease; as when the oil of the blood is diminished in quantity, and altered in quality, exudation ensues, just as it does in purpura, scurvy, &c.

But in addition to the OIL already existing in the arterial blood, as it arrives at the mouth of the Kidney, there are fresh supplies to it, whilst the artery wades through the suet to get within the bosom of the gland. Several white oil-tubes may be noticed coming from the renal gland and oil; and piercing the artery, they are lost in its coats. I doubt not, but that these OIL-TUBES convey oil into the artery.

The NERVES of the Kidney come partly from the semilunar ganglion, but more especially from the renal plexus situated upon and around the artery. The cœliac plexus sends one or

[1] Müller de Penit. Struct. Gland. [2] Mémoires de l'Acad. Roy. 1744.
[3] Meckel's Physiology.

more nerves, distinct from those which pass right or left, either to the liver or to the spleen.

Two branches come off from the intercostal whilst it is yet in the chest; and it sends a few others when it has entered the abdomen. These nerves form various ganglions, surround the arteries, and, before they pass into the Kidney, send some branches to the pelvis and ureter, and they then accompany the vessels. Thus the eighth pair of nerves contributes to form the cœliac plexus, and furnishes nerves to the Kidney.

Of the lymphatics of the Kidney.

If air be blown into the artery, the lymphatics are distended; these vessels are therefore a continuous tube. The lymphatics have their origin, I believe, in the Malpighian bodies, from which they come off, and run out of the Kidney, lying upon the blood-vessels, until they join themselves into three or five main trunks over the renal vein, and so pass on into the glands of the abdomen, &c.

These lymphatics, however, may be arranged under two heads; the one, external, to the Kidney, the other, internal. The latter are here described, but the external class of lymphatics arises on the concave surface of the Kidney, around the spot where the renal vein is issuing from the gland. Other small roots of lymphatics may be seen coming off from the upper part, and from the lower part of the Kidney; and bending towards the renal vessels, join the principal trunks that come out of the bosom of the gland. Nuck, after remarking, that the lymphatics are filled from the renal artery, and not from the vein, mentions his own opinion respecting the origin of these ducts [1].

It now only remains for me to say a few words respecting the nature and probable office of the renal glands. These bodies are situated on the upper surface of the Kidney.

Their surfaces are uneven; the upper portion is the broadest, whilst the basis is the narrowest. Along the middle of the upper portion, a ridge runs, which divides this part into two, like the middle stem or rib of a leaf; on the lower part there is an undulation like a suture.

Within these glands is a small cavity, the surface of which

[1] Vide Appendix, No. 22.

presents numerous yellow points. This colour, however, is confined to adults, for in children the surface is of a reddish tinge, and of a dark brown in aged persons. The substance surrounding this cavity is very soft, and the blood-vessels, but more especially the vein, is distributed throughout this matter. The vein of this gland passes into the renal vein, and is much larger than its artery. It communicates freely with the internal cavity of the gland, in a similar manner to the communication which is observed between the splenic vein, and the cells of the spleen. Air blown into this vein distends the renal vein, and also the cavity of the gland.

The gland on the right side lies under, and is covered by the diaphragm; that on the left, is adherent to this muscle and the spleen. These glands are surrounded by the adipose membrane, in common with the Kidneys.

The internal surfaces of the veins of the renal glands are studded with orifices; some of them, doubtless, the orifices of venous twigs, but the greater portion of them are not so. This remark brings me to the consideration of the physiology of these curious bodies. I feel assured that the renal glands perform the important office of PURIFYING OIL, which is sent into their bosoms by oil-ducts from the log around the Kidney; and they then convey it into the renal vein. These oil-ducts have been frequently called lymphatics, and mistaken for them, I doubt not; but if we carefully examine by injection, or by inflation, these oil-ducts and lymphatics, the peculiarity and various mode of distribution will be very apparent. The oil-ducts go into the renal gland, whilst the lymphatics pass over this gland to join the main lymphatic trunks, issuing from the Kidney. It is very probable also, that the renal glands receive only the "stearine," or spermaceti-like principle of animal fat, to send it into the vein, for in the lower animals, whose fat is wholly made up of the "elaine" or oily principle, these glands are absent. Thus the first principle in animal oil would be purified, and sent into the blood through the renal gland, and its vein; whilst the second or oily principle in the animal fat would be purified, and sent into the blood by the Kidney, and its renal vein.

That these glands are highly important in the animal economy, we may conclude from the fact, that they are never absent, and that they are not more frequently deficient in "monstrous animals" than are other organs.

The artery supplying this gland is a small branch of the

capsular, or sometimes the renal. Their nerves are derived from the neighbouring semilunar ganglion, and renal plexus.

These glands are found in all those animals that are endowed with Kidneys, with scarcely any exception. Thus, in mammalia, birds, amphibia, and many fish, they are readily demonstrated.

CHAPTER VIII.

ANATOMY; THE OIL-TUBES, &c.

On the physiology of the Kidney contrasted with that of the liver.

PHYSIOLOGISTS throughout all ages have agreed in calling the urine, a secretion from the Kidney; and the modern writers assert it to be, a secretion from the renal artery of this gland. I say that this has been the received opinion amongst the majority, though a strong doubt of the fact rested upon the minds of some eminent anatomists. That the urine is separated by the Kidney, no one will deny; but that this excrementitious drain is separated from the "life-giving blood," which the renal artery conveys to its bosom, is an assertion so palpably erroneous anatomically, so contrary to reason, and so opposed to the facts of daily occurrence amongst the sick, that I hope I shall have convinced my readers, and the profession at large, before I conclude, of the fallacious and untenable ground upon which such assertions have been made. If it is erroneous anatomically, it will necessarily follow that the physiology and pathology of this remarkable gland must be now viewed in a light altogether different from that in which it has been customary hitherto to look upon it.

In the history which I have given, of the anatomy and physiology of the Kidney throughout the lower animals, I took occasion to notice some peculiarities in the biliary secretion amongst many tribes. I am now desirous of pointing out the similarity that exists in the functions of the liver and those of the Kidney. The

bile is a secretion from venous blood, highly loaded with oil "after its kind," and termed portal blood. The URINE IS A SECRETION FROM OIL AND VENOUS BLOOD, which fluids, conjointly, form urine.

In many tribes of animals, both fluids are separated from the same set of veins; and "the same colouring principle which tinges the serum of the blood and the urine, impart the yellow principle to bile[1]." The liver, as I conceive, forms the pattern for all the glands. Having no fat in or around it, as is the case with other glands, the portal vein necessarily performs the office of conveying both oil and venous blood to the liver. Thus, this vein couples these two fluids in its bosom, which, in other glands, as in the Kidney, exist in separate tubes and veins.

Malpighi found ducts carrying oil, running from the oil-bags in the abdomen, to the venæ portæ, in many of the lower order of animals. Morgagni confirms Malpighi's views; and adduces the authority of Boerrhave, to bear him out in the idea, that bile is separated from blood highly charged with oil[2].

Winslow observes that, "the spleen, omentum, appendices epiploicæ, the adipose strata of the mesentery, and those of the large intestines, and even the pancreas, with the whole series of glands in the intestinal canal, seem to contribute to the formation of bile, as so many auxiliary, or rather preparatory organs; but each of them in a different way, thus:—

"1st, The blood which returns from the omentum or caul, appendices epiploicæ, and from the strata of fat through the abdomen, is loaded with oil.

"2nd, The venous blood returning from the intestines, and its glands, and from the pancreas, has lost a great portion of its serum or water.

"3rd, The blood from the spleen has undergone a certain change by its course being mechanically retarded[3]. So these three kinds of venous blood meet in the trunk of the portal vein, where they are mixed as in a lake, and become one uniform mass of blood. The cellular substance in the duplicatures of the mesentery serves to contain, also, those collections of fat which are necessary for the formation of bile[4]."

I have repeatedly examined the layers of the omentum, or caul, and its so called veins, but which are, in reality, TUBES CON-

[1] Majendie's Physiology. [2] Vide Appendix, No. 23.
[3] The blood in the spleen does not coagulate out of the body.
[4] Winslow's Anatomy, vol. ii.

VEYING OIL slightly tinged with blood. I have invariably found them in this membrane as described by Malpighi, Morgagni, and others. The globules of oil line their whole course, and pass into these tubes throughout their whole extent. But the four layers of the caul which lie between the great arch of the stomach and large intestines, send oil, by innumerable oil-ducts, into these portions of the alimentary canal. This office is also performed, with some slight variation, probably, by the appendices epiploicæ of the colon. "These fatty appendages to the large intestines terminate by a papilla, lying obliquely on the bowel, called colon, but transversely on the coat of the rectum. By blowing through a small hole made in one of these fatty appendages, it is inflated like an irregular bladder, and the air passes under the coat of the intestine. Layers of adipose matter may be also seen along the intestines, variously placed[1]."

Morgagni[2], in his chapter on the use of these fatty appendages of the large intestines, notices their nature and office; observing, that the same oily secretion that lubricates each individual fibre of a muscle throughout the body is here performed in the intestine by its several fatty appendages.

The caul performs a similar office with the liver that the "log of oil" around the Kidney does with this gland. In hyemal animals both of these reservoirs for fat become enormously distended with oil, which is exhausted when they awake out of their lethargic state of sleep.

As chyle, therefore, is essential to nutrition, health, and life, so bile is necessary to produce healthy chyle; and so, also, is oil requisite for the separation of bile. Thus there is kept up, throughout this marvellous machine, a circle and a world one within another. A wheel within a wheel; but the great Master Hand, who can know and understand! We may, indeed, fall down in humble contemplation before the High and Lofty One that inhabiteth eternity, and exclaim with His holy servants, David and Job, "We are fearfully and wonderfully made. Who can find out the ALMIGHTY, the CREATOR of the ends of the earth unto perfection? Who hath been His counsellor? Who hath put wisdom in the inward parts? Who hath given understanding to the heart? Hast thou an arm like GOD? For, saith He, I lift up my hand to heaven, and say, I live for ever. If I whet my glittering sword, and mine hand take hold

[1] Winslow, ibid. [2] See Appendix, No. 24.

on judgment, I will render vengeance to mine enemies, and will reward them that hate me. I will make mine arrows drunk with blood, and my sword shall devour flesh."

O Thou great and incomprehensible God, who is a God like unto Thee! Thou, who fillest heaven and earth, who art excellent in wisdom, power, and judgment, and who humblest Thyself to behold and pity the sons of men, though they are vile, sinful, and unclean in Thy holy sight; yet dost Thou condescend, and even command them to approach such a God as Thou art in Thy co-equal and co-eternal Son, even the Lord Jesus Christ, the mighty God, the Lord our Righteousness, our Jehovah Tsidkenu, and Prince of Peace; that our sinful souls, being washed by His blood through the mighty power of God the Holy Ghost, we might be heirs of glory, and joint heirs with Him who is God in our nature, and man in His own nature, spotless, holy, and undefiled, separate from sinners, yet their Saviour.

CHAPTER IX.

ANATOMY; THE OIL-TUBES, &c.

Further remarks on the physiology of the Kidney.

If we retrace our steps from man down the animal creation to the minutest insect of which the organization can be satisfactorily scrutinized, we find this feature pervading the whole; that oil enters largely into the composition of that venous blood, called portal, from which bile is separated.

I have shown that in the least complex forms of organization this oil passes directly into the liver, without previous admixture with venous blood, as in the scorpion. Also that with the same structure in the renal organs of the simplest insect, exists urine, secreted from oil, without the intervention of blood; and this purified oil again circulates and nourishes the animal; as for example, during the winter sleep of hedgehogs, marmots, and

mountain mice. And it is through these two media, and none others, that these animals exist from five to seven months upon the consumption of their accumulated oil.

I am convinced that some of the saline portions of urine are derived from venous blood by twigs of vessels, distinct and separate from the sacs of oil in many of the lower animals: but proceeding upwards in the scale of living creatures, we trace the two sets of tubes, "oil-tubes and urinary ducts," coming off from a complex structure, not so easily demonstrated as in the simple organization of the lower tribes of animals.

When pure alkalies are mixed with the resin of bile a saponaceous substance is the result, and is then precipitated unchanged by acids. By adding chlorine to bile, it acquires the colour and consistence of tallow, melts at 104°, and dissolves in alcohol and in hot water. This is another of the many proofs of the oleaginous nature of bile. "Wherever oil enters largely into a fluid or secretion, a sweetish taste is observed in the destructive process of analysis; such is the case with bile. The smell of ox bile is peculiar, something like melted fat. Its taste is a sweetish bitter[1]." I shall hereafter explain the melleous breath of diabetic patients, and the sweet odour and taste of the renal secretion; for this intractable, and hitherto incurable disease, I believe, arises from a decomposition of the renal and other oils of the human subject. So also in many dropsies, and in consumption, we find this melleous breath and sweet taste in the mouth. It arises, as I also think, from a destructive process going on in the animal oils.

I believe, too, it will be found, that the bile contains less adipocire, or "stearine," and more oil, or "elaine," than renal oil; consequently the blood of the hepatic vein, which contains but little of either of these matters, could never be fit for the purpose of secreting bile.

My readers must now permit me to return to a subject which I could not discuss a few pages back. It was concerning the physiology of the renal artery.

The blood, I repeat then, of this artery is as rich and full of life, for "the life is in the blood," and "the blood is the life," saith THE LORD GOD ALMIGHTY, as it is in the left ventricle of the heart. Its contents are wholly nutritious blood, and it is, therefore, a nutrient artery.

[1] Henry's Chemistry, vol. ii.

Each gland, "after its kind," separates its respective drains, or secretions, from oil and venous blood. I speak here, however, more particularly of the liver and Kidney; and, I doubt not, but that future researches will prove that the whole glandular system of secretion is effected through the media of oil and venous blood. When the arteries have conveyed their nutritious and life-giving fluid throughout the body, they become capillary or hair-like, contain white blood, and are then joined by innumerable white tubes, erroneously called lymphatics, but, correctly speaking, tubes containing oil. The blood then becomes venous. Secretions are from this mesh of vessels, which veins and oil-tubes compose.

I am further induced to think, that as soon as the oil-tubes join the capillary arteries, the blood instantly assumes a modena red or venous colour. The oil of eggs is contained in the yolk, and gives its peculiar colour to that part of the egg [1]; for before its deposition, or by abstracting this oil, the yolk is perfectly white and transparent. The dark-coloured, or pale tinge of urine, is owing to the excess or deficiency of the secretion from oil [2].

Urea in the oil [3] of the burret fish affords the beautiful purple known as Tyrian purple. I must, however, refer to this important and highly-interesting subject again under a separate department.

But let me now request my readers to consider the facts that are at present known which serve to establish the point of the renal artery as being a nutrient artery. I find nothing in the physiology of the human subject which leads us to conclude that this artery performs any other office. On the contrary, the various discoveries in the organization of animal fluids and solids, all tend to settle the question decidedly. There are many substances in arterial blood which the urine does not contain; and urine holds in solution very many principles which the most eminent chemists have never traced in the life-giving blood. I say, moreover, that if the arterial blood in the renal artery positively

[1] John Hunter, Cat. of Royal Coll. of Surgeons.

[2] A most curious and important series of experiments might be made with the yolks of eggs, which we see varying in colour from the very palest canary yellow down to the very deepest shade of gold colour, in order to ascertain the quantum of oil, which, entering into the component parts of each, might furnish its predominating shade of colour. In fact, the theory being in its first infancy, offers a wide field for experiment, examination, discovery, and utility to the chemical, physiological, and anatomical professor.

[3] De Blainville, Journal de Physique, tom. xci.

contains all the constituents of urine, why does not the blood in the hepatic artery, or any other nutrient vessel, also contain these constituent principles? We know that they cannot contain it consistently with health, and, therefore, it is evident that they do not. Can we not trace the elements of bile in the portal blood? but do we find any evidences of the existence of urine in the abdominal aorta? When we reflect upon the rapid termination of life that succeeds a sudden suppression of urine, or upon the serious ailments that arise from a scanty secretion of it, how can we consistently maintain that urine is an arterial secretion? The suppression of bile, and its consequent circulation, does not produce death in 48 hours, as is the case oftentimes with suppression of urine. The circulation even of carbonized blood does not prove fatal in this short space of time, for black blood may drag its slow course through the brain, and not destroy life; but when the elements of urine are once pent up, the result soon proves fatal. Now, aged persons, with enlarged prostates, and persons suffering from obstinate stricture, secrete, scantily, of urine, and yet enjoy tolerable health. How could this be if the renal artery is the reservoir of urine, and the Kidneys the sieve of that reservoir?

Urea is not found in the blood of healthy subjects, but it is found in the fluids of those individuals who have died from suppression of urine.` But if the usual quantity of urea be not separated by the Kidneys from the renal oil, then, indeed, it does pass into the veins of the Kidney, and circulates through the system, as bile circulates in jaundice.

I must, however, produce some striking facts in illustration of this point; namely, that urine is not an arterial secretion. A man in vigorous health passes on an average 45 oz. of urine in 24 hours. The whole mass of blood averages 400 oz. Now the urine is more than double in quantity to any of the other secretions. If one-half only of the blood's expenditure be allowed for urine, and the other half for all the remaining secretions, as bile, saliva, gastric, and intestinal fluids, fluids for lubricating joints, mucous and serous surfaces, &c., then an individual will have the whole mass of his blood exhausted in four days and a half.

A gentleman, with whom the author is acquainted, invariably resorts to a strict diet of toast and water, when an invalid, and has continued this for five or seven days together. In this condition, when no food supplies the drain which the secretions

keep up in the body, he would assuredly be dried up like a potsherd, and wasted to an alarming extent, if such an one's secretions were all performed by arterial, or "life-giving blood;" even supposing it be true, according to the doctrine of the lymphatics, by Hunter, Cruikshanks, and others, feeding, as these authors imply they do, the magazine of blood with the refuse that they take up from various parts of the body, whether healthy or morbid: but the truth is, I believe, that the invalid gentleman's system is supplied with oil, under the circumstances above alluded to, from the various deposits, or stores of this vital substance in the animal economy, as the log of oil, muscular fat, and interstitial oil pervading the viscera, and the adipose membrane of the body. This process has, to my mind, a striking analogy to the mode in which the hyemal animals preserve life, by the absorption of their fat accumulated in the respective depositories of the body. No doubt the specific weight of the invalid would vary at the end of seven days, in the same ratio as that of the hyemal brutes would do in a proportionate space of time.

Again, a diabetic man during six weeks, or even months, will pass 28 or 30 pints of urine in 24 hours at the specific gravity of 45 or 50. Here is an individual secreting from his "arterial?" blood 560, or 600 oz. of fluid in 24, or 60 pints in 48 hours, which is 555 oz. more than a healthy man secretes, and is just 200 oz. more than the whole mass of his blood, arterial and venous, combined!

I have seen 160 oz. secreted in 24 hours by a person who had unequivocal signs of an abscess in the left Kidney. He ate nothing but bread and weak vegetable broth, and yet became fat under the treatment adopted. Did he then secrete 400 oz. in two days and a half from his arterial blood? and were 160 oz. daily removed from his 400 oz. (?) of life-giving blood for excrementitious urine alone? In the case, then, of the diabetic man, he must pass more fluid in 24 hours than the whole amount of his blood. Here the blood, also, must be converted into urine long before nutriment could supply the deficiency that such a drain causes. Is it not, therefore, upon these few facts, preposterous to call the renal artery a nutrient artery if it carries, as hitherto it is supposed to do, as deadly a poison as the upas juice? It is contrary to demonstration; for the truth is, that the blood in the artery of the Kidney is wholly nutritious and life-giving blood to the gland.

PART IV.

CHAPTER I.

ANATOMY; THE BLOOD.

That wonderful fluid in which, according to the unerring Word of God, "the life is;" in which, as it were, life, or the vital link is, which joins soul to body in man, and spirit to bodily fabric in the brute creation, is called, in general terms, blood. Of this extraordinary fluid there are divisions into red and white, warm and cold, according to the nature of the animal whose vessels carry it. But waiving particulars for the present, it is my desire to consider this vital fluid in its large and general features.

Man's life being forfeited to his Creator, by his rebellion and sin, and the blood being the grand ocean or stream of his body in which life swims, the blood, in an especial manner, was considered by God to be held as to Himself in life, and to be His due in type and shadow when a beast was slain. Thus was the blood on no account to be eaten under the ceremonial law; it was to be poured out before the Lord; and this, too, day by day, and year by year, as a perpetual memorial of man's criminal and lost estate and condition before his Maker, and of the redemption-plan of blood for blood in the great atonement of the Lord of Life and Glory, as shadowed forth in every legal sacrifice. God's ancient people were, therefore, forbidden the use of blood, as well as the use of unclean beasts, for food. "Ye shall not eat the blood, for the life of all flesh is in the blood, and thou mayest not eat the life with the flesh. Thou shalt not eat it; thou shalt pour it out upon the earth as water." This command, therefore, at once opens to our minds the fact, that life, or the vital principle of an animal, exists in the blood, and is only the life considered in a natural, carnal, or fleshly point of view. All animals have blood, and, therefore, have this

life. Vegetables have a fluid somewhat similar to it, and this is the sap, within which resides the life of the plant, ramifying through its various branches in the same way that the blood circulates through its vessels.

The law, therefore, struck at the vitals. All was forfeited to God; but of the all, the law took only the best parts as a tithe of the whole, and SUBSTITUTION being the very root of redemption-work, substitution of the man's blood was daily given to God; and the shadowing of Christ's one sacrifice was constantly renewed, in the dedicating of the blood of the brute and the very best of his carcase, such as his fat, his kidneys, and his caul, to the Lord: "For without shedding of blood is no remission of sin." Not that the blood of bulls and of goats, or the fat thereof, could take away sin, or restore to Almighty favour a rebel creature; but that they were types and shadows of the One who could do so; who knew no sin, yet who, having the mighty work of redemption to do, in the fulness of time became sin for His Church, that His Church might be made the righteousness of God in Him.

The Almighty command came forth from God when the whole race of men fell in their representative and head, the first Adam: "Dust thou art, and unto dust shalt thou return." We must needs die, therefore, and shall become as water spilled on the ground, which cannot be gathered up but by the Almighty Hand that first framed and fashioned this perishable body. This glorious work the eternal hand of God will display on the awful morning of the resurrection, when the dead, both great and small, shall stand before Him; when sea, death, and hell, shall deliver up their dead, and He who hath formed a perishable body here shall also fashion the same into an imperishable body for eternity, for its immortal tenant, the soul, to inhabit thenceforward in heaven or in hell.

The word "life" is here considered independent of the soul. God gave man, by the breath of His nostrils, a living soul, innocent, pure, and holy. Man rebelled against the commands of his Almighty Creator, and was cursed both body and soul. The body was doomed to die, and to return to the dust from whence an Almighty Hand had fashioned it: the soul could never die, but was cursed to everlasting death, and sentenced to suffer, even in this state, the "fire half blown," the quickened conscience, and the beginnings of a hell within him, which, alas! the impenitent sinner oftentimes feels burning ere he has passed out

of time. But the second Adam was the LORD from heaven, who hath brought life and immortality to light, and hath triumphed over the chains of darkness, death, and hell, in which His rebellious creatures were bound. He, by His perfect obedience, and unsullied holiness, discharged our awful debt; satisfied Divine justice; obeyed, and even magnified the law; blotted out the hand-writing of ordinances against us; spoiled principalities and powers, even the powers of Satan and hell; triumphed over them, and ratified the whole by BLOOD, even HIS OWN BLOOD.

Blood, then, is not more essential to the life of the mortal frame, than is blood, holy, pure, and undefiled blood, for the eternal life of the immortal soul. The soul, washed in the blood of Him who is GOD over all, is safe for eternal glory; and as the destroying angel passed by the dwellings of those who had the brutes' blood sprinkled upon the lintels of the door-posts, even so the destroying angel shall never carry off to condemnation the soul that is sprinkled with the blood of the LORD JESUS CHRIST, which cleanseth us from all sin.

CHAPTER II.

ANATOMY; THE BLOOD.

IN the consideration of what the blood generally is, the simplest terms will suffice. Blood is composed of but few parts. The due proportion of these parts constitutes robust health. The admixture of them is a mystery. The adaptation of the whole, for life to glide forward in, as in solemn time, is a marvel, probably never to be unravelled by Him, who alone knows it altogether, to such poor ignorant creatures as we are, while the world shall last.

The parts, therefore, of which blood is composed, are, according to my demonstrations, water, glue or gluten, oil, and salts; with a free alkali and oxygen pervading the whole. The water in blood renders it fluid; the glue, or gluten, gives it consist-

ence; the oil imparts the rich colour; the salts preserve it from putrefaction; and the oxygen stimulates the whole, in circulation. Of all these component parts, the proportion is something like the following:—

Water	900
Circulating oil	$41\frac{1}{4}$
Glue or gluten	50
Salts, including those of potash, lime, iron, &c. &c.	$8\frac{3}{4}$
	1000

Oxygen pervading the whole, being in excess in arterial blood, but in a less degree, in venous blood.

The WATER is drawn off from the food, liquid and solid.

The OILS are circulated chiefly from the principal reservoirs around the Kidneys.

The GLUE or GLUTEN is drawn off by a thousand times ten thousand lymphatics and capillary vessels, from the rich, full, gluey muscles of the body.

The SALTS are derived from food received, and from the various secreting bodies within the animal frame.

And the OXYGEN is a gas imbibed from the atmosphere by the lungs, and by the skin.

When blood is removed from a healthy individual, its temperature is 98°. It is smooth and unctuous to the touch, rather viscid, and is fifty times heavier than water. Its temperature is higher or lower than the above standard, in most diseases. When blood thus drawn is allowed to stand, it soon divides itself into two distinct parts, a solid and a fluid portion. It is then coagulated. The solid portion consists of a gluey, tough, or jelly-like substance, technically called fibrine, whilst this substance retains the red colour of the whole mass, which physiologists call the red globules. The watery portion is the serum, a pale yellow, or lemon-coloured fluid.

As oils will not mix with water, I have every reason to believe that this is one cause why the clot or crassamentum separates from the serum in a strange atmosphere, namely, apart from the heat of the animal body, by reason of the little sympathy between oil, water, and glue. The fibrine of blood is similar to that substance which we obtain by the long boiling of flesh; it is the semi-transparent jelly so often seen.

What the colouring principle of the blood is, has hitherto

remained a matter of dispute. Vauquelin[1] does but assert, that which others had written of a century before, namely, that in this fluid (blood), there exists a considerable quantity of a yellow coloured fat oil, of a sweet savour, and of a soft consistence, and which has at least some analogy with grease. In distilling the clot of blood, it gives out a great quantity of the volatile alkaline salt, ammonia, and carbonate of ammonia, the ashes of which contain much phosphate of lime; a little phosphate of magnesia; carbonate of magnesia, carbonates of lime and soda. Now animal oil, as I have noticed elsewhere, contains the bases of the majority of these salts.

The same alkaline agent that pervades animal oil exists also in blood. Oil is, therefore, one of the most important constituents in blood. Hoffman[2] and Boerrhave obtained oil from animal blood. The first author gives a very excellent treatise on the uses of animal oil, &c. He remarks, that "in all animals there is a fat, oily, and inflammable substance contained. This is animal oil. It is also found in vegetables; hence, vegetable oil. Fat and oil drawn from animals, differ in many respects from vegetable oil. The former has an alkaline principle mixed with it, whilst the oil of vegetables has a subtle acid principle pervading it."

This oil pervades the whole mass of animal blood, whilst circulating within its vessels; but when separated from them, it is found both in the clot, as well as in the serum. But I am inclined to believe, that there is more of the "stearine" or spermaceti-like principle, and less of the "elaine" or oily principle in the clot, than in the serum, and vice versâ. But I am persuaded that the rich colour of blood is derived from its constituent oil. The yolk of an egg deprived of its oil, becomes white, transparent, and similar to the surrounding fluid in which the yolk swims[3]. The burret-fish, or pourpre, is also rendered purple by its oil.

Some of the above remarks proceed from observations of my own, coinciding with my views respecting the circulation of oil in the blood and in the system; and some of the hints contained in this chapter are the result of the observations of all physiologists.

It is that peculiar life-giving principle in blood, derived from its oil, which enables man and beast, "each after his kind," to

[1] Annales de Chimie. [2] Observat. Phy. et Chem.

[3] Hunterian Museum, and Catalogue.

sustain an equal temperature of body, in whatsoever region of the earth he may be placed. Thin and spare habits of body, weak and languid persons, with a feeble circulation of blood and oil, soon take cold, and are readily chilled. Fat and robust persons, on the other hand, are not so much sufferers from sudden changes of temperature. A chilliness of the loins, denoting an undue or scanty supply of oil to the blood in the Kidneys, is commonly followed or even attended by cold feet, cold hands, and a chilly surface of the body.

HIPPOCRATES[1] notices habitual cold feet, as a symptom of disease, or disordered Kidney.

CHAPTER III.

ANATOMY; THE BLOOD.

BUT I must return to the interesting fact, of oil giving the colouring principle to blood. Amongst the curious experiments that some eminent chemists have made with oil, and various substances in combination with oil, there are none more interesting than those of DELAMÉTHERIE, GEOFFREY, and GAULTIER DE CLAUBRY[2]. These gentlemen have ascertained, that a great number of colours and shades of colour, may be produced by the mixture of oil of amber and oil of thyme, with several agents. Starch and oil mixed together gave a beautiful red colour, when a feeble acid was dropped into it. This colour, however, was not stationary, but passed into a carmine. The last of the authors above quoted, mentions, that the acid gives the immediate origin to the red colour. I should therefore infer, that blood is so mixed in just proportions of oil and glue, that it only requires the constant supply of oxygen, or the acidifying basis of all substances, to perpetuate its red colour, and that when this principle is exhausted by circulation through the arteries of the animal body, the blood becomes a modena red, or purple hue, and again requires the fresh admixture of oxygen.

[1] Hippocr. Aphor.

[2] Journal de Physique.

These red and yellow colours are produced in mixing fatty bodies, as suet, oils, &c., with various weak acids, but the result is not seen, until a certain quantity of carbon has been set free [1]. How striking is the analogy with the process of respiration. Carbon is set free, and oxygen is taken in; black blood becomes bright and red, and life is fed and sustained. Therefore, when venous blood from the Kidneys, liver, and capillaries, is returning to the heart, to be propelled by this organ to the lungs, it is carbonized, and highly oleaginous; it is then in the most suitable condition for receiving a red colour by aid of the inspired oxygen. So in the case of mixing olive oil, starch, and sulphuric acid, the resulting colour was an intense red.

From lard, starch, and acid, resulted a beautiful red; oil from fish, starch, and acid, a brown red, which passed into a beautiful red. This curious subject has, however, been taken up by another very eminent chemist, as it opens upon the vegetable kingdom also. BERZELIUS examined the autumnal leaves of plants just as they assume their yellow tint, especially the beech, pear, apple, elm, and ash, whose leaves always fall yellow, whilst others, as the elder, fall green, and the oak brown. He observes, that foliage once tinged yellow, never becomes green under any re-agent; but that foliage, which has become red, reassumes a green colour on the addition of potash; because its red colouring matter forms green combinations with this alkali. The yellow leaves became gelatinous after they were boiled in alcohol, but lost little of their colour. This gelatine is owing to a fatty matter peculiar to the foliage. A saturated solution of it is converted into a transparent jelly. When the leaves were distilled, he obtained a soft fatty substance which might be drawn by the fingers into a yellow unctuous fat. This substance is mixed in the leaf, with a small quantity of fat oil, and also with another substance equally as fat [2]. This yellow colouring matter, he considers, is therefore a peculiar fatty substance intermediate between the fat oils and resins. He then examined the red colouring matter of fruits, and the red autumnal leaves of the cherry, gooseberry, &c., and he found that by abstracting the acid from the juice of these fruits, a green blue precipitate was formed. In the red leaves he obtained a beautiful grass-green after precipitating the red colour-

[1] Vide Appendix, No. 25.

[2] Botanists inform us, that an evergreen plant continues to circulate as much oily matter in its sap during winter as in summer, and that, therefore, the plant does not lose its leaves in autumn.—Withering's Botany.

ing matter, and the resinous and fatty substances. The red-colouring matter, therefore, of the leaves, gives a green precipitate with lime water, while the liquor acquires a paler red tint. The red colour in the leaves and in the fruit of these trees, is identical. Thus the basis of the colouring principles in these substances, is an acid in a peculiar state of combination with oil, fatty or resinous substances[1].

The serum or watery portion of the blood, is the fluid in which the coagulated blood swims when out of the body. It is merely a watery solution of oil with various salts. It is this constituent of blood which fills the vesicle raised by blisters on the skin. It is alkaline in character, and coagulates like the white of an egg upon the application of heat. It might be more correctly called a solution of albumen. It has a striking analogy to the fluid which lubricates the various joints, and internal cavities of the body, though less dense than the former, and more substantial than the latter fluid.

This portion of blood, which does not coagulate when removed from the body, consists of two substances. The one coagulable by artificial heat, the other not so. "Though not coagulable in itself, yet one of its properties out of the body is to coagulate upon the application of certain substances[2]." This is the principal change it undergoes, and during the process, it more or less separates into two parts, one of which is not coagulable by such means. The coagulable part seems in some degree to be the same as the white of an egg, fluid of joints, &c., and other secretions, but not exactly; for those secretions, Hunter thinks, contain a quantity of the coagulating lymph united to them, which makes them in part coagulate after secretion; and the further coagulation of those secretions afterwards by mixture with other substances, is owing to this part of the serum.

"Heat coagulates this part; and it is probably the only test necessary to know whether a fluid found any where in the body, not coagulable in itself, is this part of the serum. Heat then coagulates this serum at 160° or 165°. Air is also disengaged in the act of coagulation by heat, but not by other means[3]."

There is an important difference in the quality of the blood on the surface of the body. This variation is quite remarkable in many instances where blood is removed by cupping. The gentleman who is cupper to the hospital in which I officially

[1] Annalen der Pharmacie, vol. xxi. Edinb. M. and S. Journal, No. 134.

[2] Hunter on the Blood.

[3] Hunter, ibid.

reside, and who operates annually upon two thousand individuals and upwards, states that the blood will not only readily cup, and buff even in the glass before it is removed from the skin, but that it will do so in various parts of the same surface, in various degrees. Thus, at the edges of the pectoral muscles, and where there is but little flesh, the blood buffs as it flows, whilst a glass upon the muscle will not evince any buff on its contents. The former flows more freely also, than that from the fleshy parts; but that this difference does not affect the buffing of the blood is evident; for the blood flows slowly, and yet rapidly buffs, from the pit of the stomach. In non-inflammatory cases, the water in which the glasses are washed is tinged of a bright red. The water in inflammatory cases is not red, but muddy and dirty with a brownish ropy sediment. Blood is very sparingly obtained from fleshy parts of the body, as the chest, loins, &c., but it flows rapidly from those parts where the skin has but little muscle beneath it.

From all these remarks we learn that globules of oleaginous matter, or coagulable lymph exist in, and make up the bulk of the serum of the blood. The watery portion of oil does not coagulate, and this is that non-coagulable serum. When urine coagulates by heat, we know some derangement is going forward in the bosom of the Kidney. Those oil-tubes, whose office is to separate water, saline matter, and oil, from the log of oil and venous blood, do also set free the coagulable or oily part of the serum of the blood, and thus it is seen in the urine. This I am certain is the main spring of change of structure in the Kidney. The non-coagulable serum, Hunter likens to the gravy of roasted meat. He found it more abundant in old men and animals, whilst in lambs, mutton of a year old, and robust adults it was scarcely to be traced.

CHAPTER IV.

ANATOMY; THE BLOOD.

The blood is not of the same colour throughout the body of mammalia, or of red-blooded animals. It is red, or of a vermil-

ion hue, in the veins of the lungs which return it to the heart. It continues to be red from the left side of the heart throughout the arteries of the body, even to their minutest twigs. As soon, however, as the blood arrives in the veins, it becomes of a modena red, or purplish hue. Hence the terms arterial and venous blood. This venous or purple blood does not become red again until it enters the air-cells of the lungs, from the heart, for fresh oxygenation and purifying. This important process takes place in different ways in different animals, and in different ways also in the same animals at different periods of life. In the newt, larva, &c.[1], aeration of the blood, by means of both gills and lungs, is only for a limited period of life. But throughout the marvellous chain of God's creation in brutes this function of purifying the blood is performed in one way or other, and may be classed under four heads, or orders:—

1st, Those animals whose hearts have only one cavity, as the insect, &c.

2nd, Those whose hearts have two cavities, an auricle and a ventricle, similar to, and answering the same purposes with the right half of the heart of the most perfect animals; as in fish with gills.

3rd, Those called amphibious. In such the circulation is two-fold, although not so distinctly as in the next, because the two circulations become blended in the heart. Their hearts consist of two distinct cavities, which are two auricles, and two ventricles; but the ventricles communicate with one another, so that they are to be considered as one cavity. There the blood from the lungs, and that which has gone through the other parts of the body, mix together, instead of being separated as in the more perfect animals; so that some of the last sort is thrown back through the body again, without passing previously through the lungs; and some of the first sort is pushed a second, and perhaps a third time through the lungs, without being first employed in the general circulation.

4th, The last division is that one more immediately referring to my subject. It comprehends the most perfect animals which have a double circulation, one through the lungs, the other through the whole body; and for that purpose are furnished with a double heart. The two auricles, and the two ventricles of which they are composed, make up the four cavities by which

[1] "Caducibranchiate Amphibians."

they are distinguished. Thus the gradation is formed from perfect lungs and perfect heart[1]; first, to perfect lungs and imperfect heart[2]; then to imperfect heart and perfect gills[3], till we have no lungs, an imperfect heart, and simply perfect gills[4]. Hunter's[5] words are, 1st, perfect lungs; 2nd, perfect lungs and imperfect gills; 3rd, perfect lungs and perfect gills; 4th, no lungs, but perfect gills.

The functions of inspiration and expiration are for many important offices in the animal economy; a few will suffice to notice. The act of breathing occurs eighteen times in a minute in the adult person. During inspiration oxygen is conveyed to a surface of the lungs, averaging forty cubic feet, and dark purple or venous blood is instantly turned to a vermilion red. The temperature of the blood at this moment is raised one and a half degree. During expiration a heavy gas, carbonic acid, is sent away, chiefly from venous or black blood.

These reciprocal actions keep up a constant stimulus to the heart and arteries of the body. Animal heat partly results therefrom.

The air passes into the mouth, windpipe, and lungs at a temperature averaging 50° in this climate, and instantly comes in contact with a fluid, blood, forty-eight times hotter than itself. Yet, however, there is no sensation of chilliness produced in the act of inspiration. This is a mystery which will, perhaps, never be revealed to mortal man. It is beyond reason, and our finite minds cannot fathom it.

Throughout the whole windpipe, to its minutest branch in the lungs, there is spread over these air-passages an extremely-delicate and porous membrane. Beneath this membrane we find the countless vessels which bring the black blood for exposure to the air, and the change to red blood takes place through the medium of this membrane.

The process, therefore, which goes on with air and blood within the lungs, producing red blood, is not less important than the uninterrupted flow of oil into the blood, within the semicircular oil-tubes of the Kidney, producing, and continuing the colour of the blood.

When the arteries have permeated the various tissues and organs of the body, these vessels become hair-like, or capillary.

[1] As in mammalia. [2] Amphibia. [3] Fish. [4] Insects.
[5] Hunter's Cat. of Royal Coll. of Surgeons.

The blood in these latter channels is no longer red, but of a pale yellow, or white. Through these vessels it is passed on to the origins of the veins, where it is again coloured, but with a purple hue.

I am strongly inclined to believe that in these capillary vessels, oil, from the adipose membrane which universally pervades the body, is now poured into these vessels, carbon and carbonic acid is the result, heat is generated, and thus the temperature of the external and internal parts of the body is preserved.

That oil is fuel for heat we gather from the immutable Word of the living God. The ten virgins took their lamps, and went forth to meet the Bridegroom. The word of God would be a lamp and a light to the unconverted man, if he did not lack the oil of grace. But as he is destitute of holy fire, this Word is neither a lamp for his guidance, nor a title for admission into glory, nor a light to show him the narrow and strait way thereto.

Five of these virgins, we read, were wise, and five were foolish. They that were foolish took their lamps, but took no oil with them; but the wise took oil in their vessels with their lamps. The unction from the Holy One, God, the Holy Ghost, creates and keeps alive the spark of heavenly fire in the new man, and He leads the soul to eternal life and glory. The constant unction which blood receives from oil, in animal life, preserves and cherishes life and heat. The wise virgins took oil in their lamps. Thus the oil of grace, and the oil of animal life produce warmth, heat, fire, health, &c. The mortal spark, life, was given to the animal body when the Eternal Word went forth, and created man after His own image from the dust of the earth. The everlasting spark of heavenly fire is poured into man's corrupt and depraved soul, when the eternal God proclaims, Let there be light in that soul! and God the Holy Ghost shines into it, through the medium of His Word, in the face of Christ Jesus, the Lord; agreeably to those blessed words; "God, who commanded the light to shine out of darkness, hath shined into our hearts, to give the light of the knowledge of the glory of God, in the face of Jesus Christ."

The flame of animal life is constantly burning during time, so that there must be a proportionate waste of its food, oil and blood. God has given to every animal the power of reproducing blood within its frame, and thus the materials of a corporeal existence are renewed, and built up, during the period in which that life is prolonged.

As soon as an animal has fed upon that food which the CREATOR of all things ordained and provided for it, digestion, or, in other words, appropriation of the nutrient principles of that food to itself, immediately commences. These principles are as numerous as the kinds of food from which they are derived. They are, however, peculiar to the food received, "each after its kind," and they consist of certain minute, invisible, and immaterial agents which may be called the essence, or quinine of the food. This essential agent in food is, however, more or less, mingled with oil, fat, salt, and other animal matter, as fibrine, or gluten, albumen, &c. &c. The bulk of the food is, at length, a mass of dross, and when the animal has appropriated these essences to itself, the refuse is "cast away into the draught."

There is in every animal a laboratory, a kitchen, or, in other words, a stomach, where the various kinds of food are associated; and the processes of separation, appropriation, and nutrition here go forward in mysterious and wonderful order. Oil flows from the caul into the stomach, and the glands of this organ pour forth a fluid termed gastric juice; a pulpy mass is formed which passes out of the stomach into the bowels. Bile now flows in from the liver, and, behold! a milky, oily, nutritious fluid, the chyle, is the product. This is a process quite beyond our finite comprehensions. We are lost in wonder and astonishment as we contemplate this mysterious wheel within wheel, and link within link.

The chyle is composed of oil and serum, and some salts. It is alkaline, white, opaque, sweetish, and saline. When removed from the body, it separates, like blood, into three parts; a solid, or jelly-like portion; a slight pale lemon-coloured substance; and water or serum. The chyle is never tinged by peculiar food taken, or by medicinal agents, as rhubarb, saffron, and indigo. The roots of the venæ portæ on the surface of the stomach are the channels whereby these colouring principles get into the blood, and tinge the urine. Thus prussiate of potash taken into the stomach can be detected in the blood and urine, but not in the chyle [1].

The chyle is no sooner generated, than it meets with innumerable gaping mouths of vessels, called lacteals, ready to receive it, and carry it in their bosoms, to a main trunk or duct, which lies upon the left side of the spine. This main duct passes

[1] Gmelin sur la Chimie.

upwards along the spine, rises out of the abdomen into the chest, and discharges its rich and generous contents into the angle that the jugular vein, and vein from the arm, form under the collar-bone.

This current of oily fluid contains all the quinine or essence of the food received. It is the medium for conveying the vital or nutrient principles of food into the blood.

I must here notice another inexplicable and mysterious fact. The lacteals are endowed with life after their kind, for they will receive and take up chyle, and allow every other species of matter to pass by them untouched. They will, moreover, continue to retain this vital power of absorption some hours after the animal is dead. But they will not receive alcohol or turpentine for instance; for animals have had these fluids given them, and then have been killed. The spirit was found in the blood, but not in the chyle[1]. It passed into this fluid from the stomach through the portal veins of the liver.

If we consider the characters of chyle, we may notice that it corresponds in all points but one with blood, and that is in its colour. Thus the most perfectly organized animals have not only a double circulation, arterial and venous, and a double heart, but a circulation, also, of a fluid similar to blood, and approaching, in all its characters, to the white blood of the lower animals. This constant flow of oily chyle into the blood helps to preserve its red colour. When the chyle has passed into the vein it mixes with the blood that is going to the right side of the heart. The whole mass is then highly oleaginous and carbonized; for the oil from the Kidneys, and the oil of the chyle have contributed to render it so. It is now sent into the lungs for purification; or rather, perhaps, I should say, for arterialization. It returns to the heart, and is sent through the body by its appropriate meandering channels, the arteries.

[1] Majendie's Physiology, and Gmelin sur la Chimie.

CHAPTER V.

ANATOMY; THE BLOOD.

PHYSIOLOGISTS assert, that the blood is as highly arterial in the most minute arteries as it is on the left side of the heart, and that the blood in the smallest veins is equally as dark and venous as it is in the largest trunks. This change, therefore, of red, or arterial, into dark or venous blood is a sudden and an important one. Some addition to, or abstraction from, the elements of blood must give rise to this remarkable change. I have already asserted, that I believe this alteration in the character of the blood depends on a peculiar oil which is added to this vital fluid, and that this oil comes into it by oil-ducts, erroneously termed lymphatics, from the subcutaneous and cellular fat contained in the adipose membrane of the body.

Physiologists, moreover, assert, that the Kidneys, and all other glandular structures, except the liver, separate their respective salts from arterial blood. Now the addition of salt to blood heightens its red colour, and renders it more fluid; the abstraction of salt leaves the blood dark, and thickens it. If, therefore, the Kidneys remove all the saline matter which is found in their secretion, from arterial blood, it must follow, as a necessary result, that the arterial blood beyond the Kidneys, as the blood in the pelvis, thighs, head, and neck, &c., contains less saline matter, and is, therefore, less red than that blood which the artery has carried into the bosom of the Kidney, and that the venous blood of the gland is darker and thicker than the venous blood of those parts where no saline matter is removed.

The conclusion is plain, that if salts keep the blood red and fluid, their abstraction will leave the blood less red, and less fluid; which is not the case in the functions of the Kidney, for arterial blood is as red and as fluid at the greatest distance from the Kidney as it is within the artery of this gland. The salts of urine are, therefore, not separated from red or arterial blood. They

are, however, as I have stated, separated from venous blood, and the colour of this blood is, I have no doubt, much altered after such an abstraction of its salt; but the colour is immediately restored to it, by the oil, from the semicircular oil-tubes falling into the veins when these latter vessels get within the semicircles of the pelvis.

It has been stated, that Braconnet and Chevreuil proved that oil or animal fat is composed, among other ingredients, of volatile salt, as carbonate of ammonia, of lime, potash, iron, &c. &c. So predominant, indeed, is this volatile animal salt, that when Hoffman was going through a series of interesting experiments with various animal oils, he noticed, that, even at the moment that these oils were digested with a lixivial salt, they were themselves converted into volatile or ammoniacal salts[1].

We must, therefore, conclude, that urinary salts in their various compounds, are separated from oil and venous blood, and not from a life-giving fluid, such as arterial blood is known to be.

Before I conclude this part of my subject, I am anxious to subjoin a table of the various secretions that physiologists insist on terming "arterial secretions," with the exception of the bile. By which theory it will appear that this fluid loses more than one-half of its bulk in the ordinary secretions of the body during twenty-four hours. The amount of blood in an adult being four hundred ounces.

	oz.
Saliva[2]	16
Gastric juice[2]	16
Pancreatic ditto[2]	16
Bile[2]	20
Intestinal fluids[3]	20
Urine	48
Skin, and expired matters[3]	40
Mucus and serum of the heart, pleura, lungs, brain, peritoneum, nose, eyes, and all the joints[3], &c. &c. &c. . .	30
	206 in 24 hours.

[1] Hoffman, Observ. Anat. and Phys.

[2] From Cruikshanks on the Absorbents.

[3] From Sanctorius.

If, therefore, according to this view of the physiology of secretion from arteries, as held and taught by the modern physiologists, a man should diet himself on tea and toast for forty-eight hours, as I know many individuals to do, when out of health, he would have the whole mass of his life-giving blood consumed in secretions alone during that short space of time.

PART V.

CHAPTER I.

THE CIRCULATING ANIMAL OILS.

I NOW proceed to give as brief an outline as possible of my views, and the various observations I have made upon animal oils, and their circulation through the animal economy. In the course of these remarks, I hope to prove satisfactorily, that animal oil, in its various gradations of suet, fat, marrow, and oil, circulates through the system of living bodies, with as much order as the fluids, blood and chyle; and that this fluid is a distinct matter from either of the two last mentioned: and that the grand reservoir of this oil is the "log," or oil-bags of the Kidneys, from whence, as from a fountain head, the mass of blood is supplied with rich purified oil for the preservation of the life, heat, and nourishment of the animal. This important and vital office having been performed within the Kidneys, and the oil carried throughout the body, this fluid is deposited in a mysterious order, and with wonderful regularity, in shapely portions of solid fät through the various fibres, and within the layers of the muscles.

The modern doctrine of the lymphatic vessels, and of the processes of absorption, will be also adverted to, and the discrepancies of opinion amongst physiologists concerning the absorbent system, and the lymphatics will be cleared up, it is hoped, in the course of my further observations.

Before, however, we can rightly judge of the nature and character of oil, we must view it in its natural temperature, and there mark its properties. The clot or crassamentum of blood is like any thing but the flowing liquid in the animal's veins; so the circulating oils of an animal, like the blood, are ready to congeal in their parts, when placed in a new atmosphere.

The fat of animals may be divided into four kinds, with respect

to fluidity:—oil, lard, tallow, and spermaceti. The seasons, however, in this climate, are often so cold as to destroy some of these distinctions; for in winter the oils are crystallized into lards, and lards almost into tallow, but the summer rarely melts lard into oil.

Hunter's observations on whales and animal oil are extremely interesting, and very much to my present purpose; I shall, therefore, draw many remarks from his useful paper.

"Some of these four substances are peculiar to some animals, and others are almost common to all. The first is the most universal, many animals having no other fat than oil, while there are but few animals without it, although they may be also possessed at the same time of either the second, third, or fourth kinds of fat. Oil alone, I believe, is found in fishes, and in some of the whale tribe, as in the whalebone whale, porpoise, &c.

"Lard, I believe, is seldom found alone; it is in general found in common with oil. Lard is found in the hog, horse, and in the human subject, and, I believe, in most birds; as also, in the snake, lizard, and likewise, I believe, in the turtle.

"In the feet of the horse and the hog is found oil; and I am not certain if it is not oil which is found in the legs and toes of the goose, duck, &c.

"Tallow is found in the ruminants; I believe in every one of that order. The camel has it. In the feet of many, if not of all the ruminants, is also found oil. Spermaceti is only found in one species of the whale: in the same species is found oil, and, I believe, this is the fat of all the others of this tribe. Besides those above described, there are fats of an intermediate consistence. The fat of a dog, cat, &c., is firmer than hog's lard, but is softer than tallow. In some of those animals that have two kinds of fat, it is in some places distinct, and in others mixed[1]."

Such is the outline of the different kinds of fat, given by the indefatigable John Hunter, and it is a matter of surprise to me, that this eminent physiologist should have asserted that fat was "not an animal substance," that it was "no part of an animal," and that it was "to be considered as an adventitious matter." But when I shall notice elsewhere, that this anatomist held some ideas, as he says, peculiar to himself, respecting the absorbent system, I do not wonder at the mistake he has fallen into. For he confers on the absorbents a power of

[1] Hunterian Catalogue.

taking up "extraneous matter, superfluous and extravasated matter, fat, diseased and dead parts, which were beyond the power of cure;" and thus makes them convey a heterogeneous compound of any dead matter into the life-giving blood of the animal. In short, he holds that "the absorbents are often taking down what the arteries had built up." These opinions were acted upon, and followed out by his pupil, Cruikshanks, who published a work on "the Absorbents of the Human Subject." In the preface of this book, Mr. C. makes this remark. "It is not likely that the Author of nature would have made two sets of ducts in the body to accomplish the same end." But I answer, this is actually the fact; and that the two sets which he objects to in his preface, he virtually proves, in his work, to exist. One set passes through glands; the other set does not so. One set removes useless matter as gangrenous flesh, nodes, and extraneous fluids, carrying them into the intestinal canal; the other set, which passes through glands, removes or absorbs fat from the various muscles, and, as in the bodies of dormice, &c., during winter, goes to nourish the blood, and, consequently the body, when no nourishment is received into the stomach.

CHAPTER II.

THE CIRCULATING ANIMAL OILS.

Animal oil has been investigated by many eminent physiologists besides the one last-named; and amongst them, we find Malpighi, Perrault, S. Collins, Hartsöeker, Morgagni, Haller, Boerrhave, Lewenhoek, the Parisian dissectors, Vieussens, Hoffman, and Winslow. The opinions of these anatomists were unanimous, that animal oil circulated by globules, in distinct vessels, or tubes in the body. Malpighi examined the caul of the ruminating animals. He noticed the globules of oil issuing from the membranous sacs of which the fatty masses are composed; these little sacs, together with arteries and veins, formed a net-work. The course

which the oil took was, to this anatomist's eye, evidently different from that of the surrounding blood-vessels, and he did not confound these vessels with the oil-ducts. These fatty globules are always seen alike throughout the body of the animal. Different animals, however, present a difference in the character of the globule. That these globules of animal oil are invested with a delicate membrane, we may assure ourselves by the aid of the microscope.

The microscope, indeed, has instrumentally done marvels in drawing aside a little corner of the amazing veil of nature. But what are all the microscopes of ten thousand worlds, in comparison with one fair page of the revealed mind and way of HIM who created the materials, and then made the object out of the material, agreeably to the Eternal Word of GOD, as well in the text as in the remarkably preserved context, taken from the Hebrew, and placed in the margin of our bibles? thus:—"And GOD blessed the seventh day, and sanctified it; because that in it He had rested from all His work, which GOD created AND made," in the margin (Hebrew) "CREATED TO MAKE." (Genesis ii.) Also, "in the beginning, GOD CREATED the heaven and the earth;" here was creation of elements, or the materials; "and the earth was without form and void; and darkness was upon the face of the deep;" (Gen. i.) and then the employment and arrangement of the created materials: "And GOD said, Let there be light: and there was light." "And GOD divided the light from the darkness." Light and darkness, the firmament and the earth, and the deep being created, as one mass of material to make from, and with, they lay, as it were, heterogeneously together, as the work of the Everlasting Word, the SON, by whom all things were created according to the counsel of the Eternal GOD the FATHER; and they waited, as it were, the life-giving power of the HOLY GHOST, the Spirit of GOD to move upon, as He moved upon the face of the waters, and to bring forth, what to the birth was brought; and they were brought forth into life, and each was perfect in its kind; and in their nostrils, whether beast, fowl, or creeping thing, was the breath of life, the vital spark; or, according to the Hebrew context, "the breath of the spirit of life." Gen. vii. 22, margin.

Here, we know, is the origin of all creation, and as the foundation of eternal truth for any doctrine we may indeed say, My foot stands on rock work: man cannot, if he would, throw me down from that—for I am but repeating what GOD tells me. Yet, may

we exclaim, and it is our sin and our shame that our slothfulness and our earthliness should so hold back, even Christians, from the searching study of God's word; "How little a part of Him is known!" "Who hath known the mind of the Lord?" Who, indeed, may presume to say, what depths and heights were in the parallel lines drawn in the majesty of God's purpose, when He traced forth the sketch of the four kingdoms of earth, animal, vegetable, mineral, aquatic! When the spirit of the words, "circulation," "vibration," "oscillation," was carried out into being! When He placed the ramifying blood-vessel by the side of the veiny leaf and the porous trunk; and said to the blood, "Circulate!" to the sap, "Go forward!" when he said to the earth, "Let rivers and rivulets flow in thy bosom, and progress, wave by wave, to the ocean; and as oil, the type of My favour to created objects, shall be expressed from almost all things in three of these kingdoms, so let the type of life and of atonement for man's transgression be seen in the flow of waters in their beds or channels, as the blood [1], which is the life, circulates and beats on in the veins and arteries of the animal kingdom."

And, hence, is oil discoverable in mineral, vegetable, and animal. Hence, the acceptable offering of man to God being the best, the warmest, the most unctuous, the most curious, the spring and source of re-production, the choice or unctuous, the best and worthiest parts of created things, are emblematical of vital union with the Creator, who pours down an unction, spiritually, as the man was commanded to carry back the object typically to Him from whom it came. With Himself, God begins in His office of Anointer. "Ye have an UNCTION from the Holy One," "The anointing which ye have received of Him abideth in you," Epistle of St. John. "Now He which hath anointed us is God," 2 Cor. Next comes the God-man Mediator's spiritual anointing; "unto the Son" (the Father) saith, "Thy throne, O God, is for ever

[1] So that wonderful declaration of God in Genesis ix., showing, and can we hear it too often? that the blood being the life of man, that life is forfeited to God by man's rebellion in Adam, his own original and actual sin; thus as God declares to His servant Noah:—"And SURELY YOUR BLOOD OF YOUR LIVES WILL I REQUIRE; at the hand of EVERY BEAST WILL I REQUIRE IT." Here comes forth the blessed doctrine of substitution; the blood of the beast as a type of the precious blood of Him who was to come down from heaven; to take into His Godhead, our manhood, and, as man, suffer in our stead—bear the sins of His Church, stand as our substitute before God's bar of judgment, be found guilty as our sin-bearer, be condemned, and executed; rise again after His triumphant conquest over death and hell, stand before His Father justified, and so giving to us His righteousness, we stand before His Father spotless as Himself! O blessed truths for a dying head to rest in and on.

and ever, &c." "Thou hast loved righteousness and hated iniquity, therefore God, even thy God, hath anointed Thee with the oil of gladness above thy fellows." Next in gradation comes the High Priest; "He was anointed with holy oil—oil beaten out from the olive." The holy candlestick of pure gold was fed and kept a-light with this beaten and consecrated oil. The ministering priests come next, "And they were anointed also." Anointing was annexed to high and holy office. Kings were anointed, as were the vessels of the Sanctuary. Oil, marrow, fatness, were ever emblems and types of the rich favour and blessing of the Lord. Healthy bones were called fat; to be "full of marrow," was a signification of a rich and unctuous state of soul as before the Lord. Fruitful earth was called "fat." An acceptable sacrifice before the Lord, was termed a "fat" sacrifice; as in the margin of the xxth Psalm. A holy feast was "a feast of fat things." All these offerings rich and fat, were in other words, acceptable offerings in God's sight. Whereas, the self-righteous man, "not rich towards God," according to Christ's expression, but rich only in and to himself, is, according to holy writ, "enclosed in his own fat," and, consequently, an abomination.

Can we feel surprise then, that the one pre-eminent object typical of self-dedication to God, in His own appointed way through rich unction and anointing, should be especially applied, by Him who made all things, and all animated nature, to the vital, and rich, and best portion of each object respectively? Vital substance being the Kidney, and vital fluid the oil.

CHAPTER III.

THE CIRCULATING ANIMAL OILS.

The words of Scripture are, "The fat of the Kidney of wheat."—Deut. xxxii.

This substance, which God calls the Kidney of wheat, is the fattest and most nutrient portion of this grain. It is the meal or flour of wheat, rye, oats, &c., and, indeed, of all sorts of

seeds. This nutriment, and life-giving principle of the seed, is shut up, according to Lewenhoek, in little cells or chambers; the cells are separated from each other by thin membranes, which are thinnest in wheat. If the seeds of plants are exposed to too great a moisture, or are shut up in a damp place, they become mouldy, the nutrient principle, or the Kidney of the grain is destroyed, and it will never vegetate if sown. On the other hand, a long-continued heat will destroy the life-giving principle of the plant, and its oil becomes either putrescent, or is volatilized. The membrane which encloses the fatty globules in an animal, are difficult to detect, because the least heat or pressure melts them away and destroys them; for if the fat be melted, and then submitted to examination, not a vestige of these membranous sacs can be traced. The above-mentioned naturalist had kept some ox suet for four years, and on looking at it, he found the mites had devoured a large portion of it. He submitted the refuse to the microscope, and found that the insects had eaten the oil from a multitude of globules, and had left the little husks or bags completely empty. Thus he fully satisfied himself of the nature and character of these membranous sacs.

All fat substances in the animal kingdom are enclosed in an innumerable multitude of these transparent bags. On examining suet as we meet with it in animals, especially that around the Kidneys, we find it arranged in conchoid, square, or round masses, separated from each other by membranous laminæ. If each of these masses is examined attentively, we see them entirely formed of an infinite number of oblong globules, transparent and brilliant, like a crystallized salt, and they seem tied to each other by a very loose membranous texture, like the grains of starch in a boiled potato. We may separate these globules from each other by slightly macerating the suet in cold water, and then shaking it over a hair-sieve. The same conformation of the globules of oil may be seen in vegetables also. The corpuscules which constitute the dust of the leaves, and the fruit of plants is found to be analogous to wax [1].

On examining this dust with the microscope, we see it formed of transparent grains, the form of which varies with the species of plants. Analogous formation may be traced in the waxy substance that coats the surface of myrtle berries.

The volatile oils are also enclosed in small membranous blad-

[1] Annales de Chimie, Proust, ibid.

ders, hence the various botanical terms of "vesicular," "miliary," "globulous" glands, these reservoirs being filled with oil.

The accumulated globules of oil in an animal are very similar to a collection of minute grapes, and from these little masses issue others, even smaller than they are, which are very apparent upon the caul of an animal. Fifty globules of the oil of a plaice are no larger than one ordinary fat globule which the naked eye can take in. A globule of oil has not a perfectly round form. There is an indentation on one portion of its circumference. At least, I think, this is the case in the oil of most animals. That the oil can go in and pass out of its membranous sac there can be no doubt, because we find more water and salt in oil at one time than at another; and so in dropsy we have the oil-sacs saturated, if I may so speak, or filled with water, instead of rich, pure oil. The mites having devoured the oil and left the husk perfect, as in the above instance, is another proof that these oily sacs have openings.

Piccolomenæus and Cortesius describe the masses of fat in the caul. They noticed the globules of oil in this membrane, passing along its white oil-ducts, to empty themselves into minute origins of the portal vein around the stomach and intestines. The latter author expressly guards his readers against the supposition that he saw and described blood-vessels, for, he observes, that veins and arteries ran along the sides of these white oil-ducts of the caul, and were not confused or entangled, but they were all arranged in a reticulated form along the caul. These appearances I have myself constantly seen on the caul, and there can be no doubt but that the net-work of which these and other authors speak, is a sort of satchel in the meshes of which are contained many hundred globules of oil; these globules pass out of the meshes of this net, by the white ducts which are the boundaries or circumference of each satchel. The minute net-work of arteries and veins, runs at the sides of these satchels, and is continued on to their termination, in the same way that the pulmonary vessels of the lungs surround each air-cell of this organ. Thus it happens in the examination of a caul, or a portion of the adipose membrane, that we notice empty spaces or nets, whilst others are so filled in their interstices with oil, that all traces of a net-work have vanished. The same structure, under some modification, is seen in the lower animals. In frogs, in lieu of an omentum and of renal fat, there are distinct oblong grooves, or little sacs in the abdomen, filled with oil; from the sides of

these sacs, a copious mass of fat is poured out similar to that which I have described in the caul of mammalia. In the serpent and lizard, these fatty layers are extended through the whole length of the abdomen from both sides of the intestines, become fastened to these organs, and the layers of this fatty mass send slender branches or ducts to the portal vein, and often swell out, in those animals that are otherwise very fat, into large lumps or heaps of fat. If, therefore, we picture to our minds the central rib of a leaf, with its numerous small branches going off from it, and forming a net-work on the green of the leaf, we shall have the resemblance of the minute arteries and veins of the caul in mammalia; now within these small nets are grouped innumerable globules of oil, just as grapes are huddled together on the stem. From these descriptions there can be no doubt, but the fat or oil is deposited throughout the animal body from the arterial twigs; that these depositions, also, are to answer separate and distinct offices, there cannot be any dispute, as in the caul and mesentery for the formation of portal blood, hence, bile; in and around the Kidneys, hence, urine; subcutaneous or cellular fat, hence, perspiration; &c.

These secretions are so many drains from animal oil. The purified oil remains behind, and furnishes nourishment, life, and heat to the animal. But what set of vessels remove or take up this deposited oil? HALLER thinks that the veins take it up. STEPHEN HALES injected the veins of a dog, and the cells of fat were filled. But no physiologist has yet decided the first, by far the more important question, how does the oil enter the blood? My reply is, first, by the grand reservoir, the oil-bags of the Kidney; and, secondly, by the millions of gaping-mouthed oil-ducts which pass from the adipose membrane of the body into the blood-vessels; and these are the tubes which have been confounded with the lymphatics. I propose to call them THE OIL-TUBES OF THE ADIPOSE MEMBRANE. If, therefore, this point be decided upon, we shall have no difficulty in settling the matter. For the same vessel that removes oil, also carries it into the blood. Hence, the innumerable oil-cells of the body may be injected either from arteries or from veins; but they are never injected from the vessels now known as, and called, the lymphatics.

CHAPTER IV.

THE CIRCULATING ANIMAL OILS.

There are many curious facts connected with the chemical composition of animal oil; it is now desirable to consider a few of them.

The oil that is obtained from vegetables may be a fixed or a volatile oil. The former substance is obtained by expression of the vegetable matter; the latter, by distillation. An acidifying base pervades the oil of vegetables, which may be readily known; if these oils are allowed to remain any length of time in copper vessels, the metal becomes green and corroded. This result can only arise from an acidifying principle in the oil. Animal oils, on the other hand, contain a volatile alkaline principle. For if this substance be preserved any time in a copper or silver vessel, a beautiful blue colour tinges the metal which is in contact with the oil. This appearance can only result from an alkaline base in the oil.

This alkaline base is, however, in the form of a salt, the volatile animal salt, ammonia, and its carbonate. This salt may be distilled over, in great abundance, into a retort, from the destructive distillation of animal oil. Hoffman found, as I have noticed before, that the oil which he distilled from the blood of various animals, and that from hartshorn, ivory, &c., if long digested with vegetable salts, was converted into volatile or ammoniacal salts. He adds, "the volatile alkaline salt, therefore, contained in the oils of animals, is the reason why they are far more subtle and penetrating than the oil of vegetables, and that they have a more immediate tendency to dissipate tumours, and other indurated swellings[1]."

Thus we see the reason why the urine contains so much lithate or purpurate of ammonia. It is derived from the oil of the animal, and not from its blood.

[1] Hoffman, Obs. An. et Phy.

I have already alluded to the valuable researches of Chevreuil, Braconnet, Vauquelin, and Fourcroy, upon this animal matter, oil. I must, however, recur to some of the experiments of these eminent men, in order to show something of the component parts of animal oil.

There are two distinct principles in this substance, suet [1] and oil [2].

These principles are, however, liable to remarkable variations in relative quantity in the animal. The physical constitution of the beast, the nature of its food, and the spot where it is domiciled, influence the character of the oil in a surprising manner. Thus Braconnet found that the butter of a cow, during the summer months, yielded sixty parts of oil and forty of suet; whilst the same substance obtained in winter from cows which were grazing on the mountains yielded thirty-five of oil and sixty-five of suet. That from the mountain cows is more esteemed than that from the milch cow or kine of the plain countries; for this last is less oily, paler, firmer, and contains more suet than the former. The suet is far more abundant if the animal has been fed on dry forage; for the butter, under such circumstances, is hard and compact, a dull white in colour, and is inferior in quality.

This remarkable difference in the quality of winter and summer butter can only arise from a corresponding variation in the quality of the animal fat, or oil. I have no doubt that this substance undergoes very important changes in its composition, not only in summer and winter, but also in tender age, maturity, and old age. I gather this information from the unerring Word of God.

Under the sacrificial law the Jews were commanded to offer up to the Lord a tithe of their whole flock, and this portion was to consist of the best of the flock. We never find, therefore, that an old ram or old bullock were to be laid on God's altar. In these animals the oil is deteriorated, and not so rich and luscious as in the young kid or lamb. It is expressly ordered that the lamb, kid, and calf should be of one year, and the young heifer of seven years. Neither more nor less in age would have rendered it fit for acceptance on the altar. In short, the identical period of the animal's prime would not have been attained; whether of the firstling, called young and tender, or of the animal arrived at rich and full maturity.

[1] "Stearine." Chevreuil, Annales de Chimie, vol. xciii. Phil. Mag., vol. xlvi.
[2] "Elaine," ibid.

It was not until the experiments of these eminent chemists threw an extraordinary interest into the character and quality of animal oils, &c., that physiologists and chemists were brought to consider the fat of organized bodies as formed of several substances, as having the same essential properties, and differing only by its firmer or weaker consistence; hence the various denominations of suet, lard, fat, marrow, oil, grease, &c. &c., admitted by the ancients. This consistence of fat, however, varies in a remarkable manner. It is hard in the ruminating quadrupeds, out of the body; softer in man than in animals which live upon vegetables only; almost liquid in the amphibious mammifera, the whale tribe, as well as in all the carnivorous animals, whether birds, reptiles, fishes, or insects. Not only does the consistence of the fat vary in the different kinds of animals, as in the several regions where this substance is found, but it varies, also, according to the age, sex, and physical constitution of the animal. It is very hard, when cold, around the Kidneys; rather soft in the caul, the intestines, and around other moveable organs; and it is almost liquid where it coats the eye, and forms a warm cushion on which this organ rests.

When we reflect on the almost infinite variation in the consistence of suet, fat, and oil, through the animal economy, it does not surprise us that this substance, fat, should be found to consist of many elementary parts. Let me then notice, in general terms, that all animal oils, of every consistence, are invariably formed of two principal substances, suet and oil. The former is a more solid, compact, and whiter substance than the latter. If a portion of fat is treated with a hot ley of potash or soda, the constituents re-act on one another, and a solid, pearly, crystallizable substance, named, by Chevreuil, "mother of pearl substance," is the product, together with a fluid oil, and a third matter, which is SWEET. The latter substance remains free, but the two first enter into a species of saline combination with the alkali. The importance of this chemical change in the nature of animal fat with alkalies will be further considered in the treatise on the diseased oils of the Kidney. I shall then give my opinions on those alarming and often fatal attacks of concretions within the bosom of the Kidney, which, as I believe, originate in a separation of this crystallizable principle in oil, and thus becoming a germ for future deposits around it; a true calculus or stone is hence formed.

The separation of the "sweet principle" will be referred to

also, and it will be shown that diabetes or saccharine urine is exclusively a disease of the OILS of the Kidney.

Before I pass on, however, to the consideration of the elementary parts of fat, I am desirous of giving a general outline of the two principal constituents of fat in some animals, and of the temperature at which it melts in each one.

The fat of the human subject contains a larger portion of this crystallizable substance than the fat of quadrupeds [1].

		Oil.	Suet.	Melts at
In 100 parts of	Human fat . .	20	80 ?	150°
	Mutton marrow .	74	26	124°
	Mutton fat from the Kidneys .	25	75	142°
	Beef marrow . .	24	76	140°
	Beef fat	30	70	135½°
	Hog's lard . . .	62	38	100°
	Goose's grease .	68	32	110°
	Duck's ditto . .	72	28	126°
	Turkey's ditto .	74	26	113°
	Olive oil . . .	72	28	
	Almond ditto . .	76	24	
	Rape ditto . . .	54	46	

By this interesting table, for which I am partly indebted to the researches of Braconnet and Chevreuil [2], it is apparent that the preponderance of suet, or the crystallizable substance in animal fat, prevents this matter from melting at so low a temperature as those fats that have less suet and more oil in their composition. This result we might, however, anticipate, because the "mother of pearl" substance in suet does not melt, when separated from its combined oil, at a lower temperature than 135° or 140°; whilst the oil, when removed from its suet, is fluid at a temperature as low as 60° and 65°.

The two substances in combination, under the form of fat, require a temperature of 110° to 150° to melt them according to their relative proportions of oil and suet.

Prior to the experiments of these eminent chemists, our countryman, J. Hunter, had instituted a similar series of observations upon the various tribes of whales. This physiologist says, that the spermaceti is found every where in the body, in small quan-

[1] Gibbes; Phil. Trans., 1794 and 1795. [2] Annales de Chimie, ibid.

tity, mixed with the common fat of the animal. In the head it is the reverse, for there the quantity of spermaceti is large when compared to that of the oil, although they are mixed, as in other parts of the body. These two kinds of fat in the head are contained in cells, in the same manner as the fat in other animals; but besides the common cells, there are larger ones, or ligamentous partitions going transverse, the better to support this vast load of oil, of which the bulk of the head is made up. "Above the nose," he continues, "I observed a great many vessels, having the appearance of a plexus of veins, some as large as a finger. On examining them, I found they were loaded with spermaceti and oil; and that some had corresponding arteries. They were, most probably, lymphatics." He then describes the mode by which he crystallized the spermaceti, after separating it from its component oil. It crystallizes, however, when combined with its oil, if cooled to a certain degree. When very much diluted with the oil, it is dissolved or melted by a much smaller degree of heat than when alone; and this is the reason, perhaps, that it is in a fluid state in the living body.

The following remarks are highly interesting in a medical point of view also. "If the quantity of spermaceti be small in proportion to the other oil, it is, perhaps, nearly in that proportion, longer in crystallizing; and where it does crystallize, the crystals are much smaller than those that are formed where the proportion of spermaceti is greater. From the slowness with which the spermaceti crystallizes when much diluted with its oil, from a considerable quantity being to be obtained in that way, and from its continuing for years to crystallize, one would be induced to think that perhaps the oil itself is converted into spermaceti."

"It is most likely, that if we could discover the exact form of the different CRYSTALS OF OIL, we should thence be able to ascertain both the different sorts of vegetable oils, expressed and essential, and the different sorts of animal oils, much better than by any other means; in the same manner that we know salts by the forms into which they shoot. I have endeavoured to discover the form of crystals of different sorts of oil, but could never determine exactly what that was, because I could never find any of the crystals single, and by being always united the natural form was not distinct[1]."

[1] Hunter on Whales. Phil. Trans., 1787.

It is impossible to say what valuable results might have been obtained had the above suggestions of Hunter been followed up; for I believe that the preponderance of this spermaceti-like and crystallizable principle is the foundation of numerous diseases in the human body, as stone, gouty concretions in or around joints, scrofula, and, probably, cancer, &c. &c. It only requires a peculiar variation in its other constituent, oil; and this substance has a tendency immediately to crystallize in the animal body.

But I shall now pass on to the consideration of the "mother-of-pearl substance," or spermaceti-like principle in the suet of animal fat. In order to obtain this peculiar matter, we must deprive the fat of its constituent oil by melting it, and then adding turpentine to the hot fluid, the suet will be left upon pressing the mass, when cool, in a linen cloth or blotting-paper, and the oil is absorbed by the linen.

By adding nitric acid to the suet thus obtained, a concrete substance is formed, the acidity of the former, in a great measure, disappears, and the resulting compound is of a snowy white colour, of a pearly lustre, inodorous, not very sapid, pulverulent, soft, and unctuous, and resembles spermaceti. It is, however, more soluble than the latter in warm alcohol; for the spirit takes up such a large quantity, that the liquor runs into a solid mass upon cooling. If, however, the alcohol be very much diluted, snowy-like flakes are precipitated, formed of a net-work of very fine needles like crystals. This constituent has been termed the "mother of pearl substance," or "margarine[1]," by Chevreuil. Ether and turpentine perfectly dissolve it; and if the solution be evaporated, crystals are beautifully formed during the process.

The suet from which the "mother of pearl substance" is obtained, by the process now detailed, is analogous to wax. It is compact, dry, and brittle. It waxes surfaces, and imparts to them a glossy appearance like bees'-wax, giving the same noise when rubbed.

Yellow wax melts at the same degree of heat as mutton suet, that is, 142°. This waxy substance in suet has such an aptitude to combine with the alkalies, that it disengages the carbonic acid from the alkaline carbonates to form other compounds.

From these facts respecting the chemical composition of fat, I am persuaded that the abuse of ardent spirits, all of which

[1] μαργαρίτης, a pearl.

contain alcohol, materially affects the circulation of the animal oils. The suet of the Kidneys is dissolved too rapidly by the action of spirits; an impure oil thence circulates in the blood, and this vital fluid, instead of being rich, generous, and substantial, is thin, poor, dark in colour, and is prone to take on an acidifying tendency.

In confirmation of this idea, I have never failed to find the blood of hard spirit drinkers, who have died from "delirium tremens," universally fluid, dark, and thin; the heart flabby, and the large blood-vessels stained on their internal coats from the altered condition of their contents.

I am satisfied that this fatal disease originates in a peculiar decomposition of the animal oil of the body, but more especially of that of the Kidney; for I have, in every instance, traced the disease to a co-existing separation of a quantity of high-coloured and very heavy urine from the Kidneys.

It appears, then, that animal fat, instead of being considered a simple substance, as formerly, ought to be looked upon as a compound body. The principal component parts of which are oil and suet. But even these are by no means simple substances. Oil is composed of water, and of a substance inflammable and highly carbonized; whilst suet is made up of a small portion of this oil; but the larger portion consists of the pearly and crystallizable substance known amongst chemists as "margarine[1]." The margarine of suet contains some important matters, and performs most interesting offices in the animal economy. It is this constituent in animal fat which gives rise to the secretion we term urine. All the salts of the one are separated by the Kidneys, and carried away, in the process of purification, into the other. Margarine consists of a fatty matter, combined with potash, lime, and oxide of iron. When boiling alcohol is poured upon it, the combination of this substance with its potash is destroyed. It is of a pearly whiteness, and resembles white wax, or, as I have before remarked, the spermaceti of the shops. It melts at 154°, is lighter than water, and can be crystallized into brilliant needles of the most delicate whiteness. By distillation, sixty-two grains of this substance yielded charcoal, lime, potash, and iron, and a second product remained in the retort, which was tinged yellow, and was about two-fifths of the whole[2].

[1] This principle forms the basis of the margarita tapers.

[2] Chevreuil, Annales de Chimie.

This latter product, I think, is oil not separable from the margarine. For if we attempt to combine it with potash it melts into an oily fluid.

If animal fat is heated in a retort, there will pass over carburetted hydrogen, an inodorous oil, and an ammoniacal salt, together with an oily fluid which holds acetic acid in solution.

If urea is similarly heated, there passes over carburetted hydrogen, and an ammoniacal salt; and, if a little dilute vitriolic acid is added, there will further pass over a quantity of oil and acetic acid[1]. Who does not immediately recognise the identity of the two substances? The only difference exists in this: that the one is an animal matter which has never been acted on by a vital organ, the Kidney, for instance, whilst the other (urea) is a substance separated, first, by these glands, and then extracted from the renal secretion by the artificial process of the chemist.

CHAPTER V.

THE CIRCULATING ANIMAL OILS.

Having briefly opened the subject of the chemical composition of animal fat, so I must now, in as short a space as possible, consider the use, situation, and nature of fat in a physiological point of view.

Every animal, from the minutest insect up to man, subsists upon oil. Oil generated within its own body, "each after its kind." The future offspring, whether it is enclosed in the egg of the oviparous animals, or in the spawn of fish, or in the fœtus of mammalia, is richly supplied with oil. I have already explained the situation and nature of this oil in the egg, and in the fishes' spawn. But in the fœtus of mammalia this important substance runs along the edges of the umbilical cord, and can be traced as far as the extreme points of the umbilical veins in the liver[2]; and when within this organ it is received into the hepatic veins, and

[1] Henry's Chemistry.

[2] See Preparation (1825) of Fat around the Human Umbilicus in Hunt. Mus. R. C. S.

thus circulates through the fœtal system. "For what is most extraordinary," remarks Sir Charles Bell, "is this; that the proper function of the liver is not performed while the fœtal circulation continues; and it is only when the blood of the umbilical vein is cut off, and when venous blood comes slowly up from the veins of the abdominal viscera to fill this extensive system, that the true and stimulating bile is formed in the liver[1]."

We must always bear in mind, that the blood of the fœtal liver is circulating in two directions; the right side is filled from the venæ portæ, the left side by the umbilical vein. These two currents fall into one, and are blended together in the liver, and then pass into the right side of the heart by the ductus venosus. I consider, then, that this gland receives oleaginous blood from the mother by the umbilical vein, and portal blood from itself, from which oily blood, bile has not been extracted, and both are carried into the heart for general circulation. I cannot look upon the mass of fat around the umbilical veins as destined to serve any other purpose; and since we find new-born animals scarcely anything but fat, there must be some grand source and fountain-head from which this substance is obtained.

There have been diversities of opinion upon the generation of fat in animals, but it is a subject that is far beyond our finite minds. Well may we exclaim, with the wisest of kings, "As thou knowest not what is the way of the spirit, nor how the bones do grow in the womb of her that is with child, even so thou knowest not the works of God, who maketh all." Haller asserts, in speaking of the prodigious growth of fat in animals, that an ox, weighing five hundred pounds, may rise in weight to two thousand eight hundred pounds, which is half the weight of an elephant[2]. Fat is traced in the smallest insects and ephemerides. The sloth, whilst he wanders from tree to tree without much labour, grows to an enormous size; having descended, he remains some time fasting, and becomes as thin as a skeleton[3].

The most convincing argument that can be offered in proof of the assertion, that all animals require fat for life and for nourishment, is deduced from the curious changes which hybernating animals undergo prior to their falling into the winter lethargy.

Masses of fat are found in the chameleon, lizard, frog, snake, dormouse, bat, marmotte, hedge-hog, and bear, &c. &c. before the winter. These masses have wholly disappeared when they

[1] Bell's Anatomy, vol. ii. [2] Haller, Elem. Physiol.
[3] Dampier's Voyage round the World.

awake in spring[1]. Many of these animals become so bulky, that they can scarcely move onwards prior to their winter's sleep.

The situation of fat in various animals is not in the same proportion, nor of the same quality in the same part of different brutes. In fish, the fat is dispersed abundantly through the liver; and in the salmon, trout, sprat, it is found in the caul or mesentery, but in the ray and cod, and in all those called white fish, the fat is scarcely found any where else but in the liver, and in this gland it is very abundant. In fish and amphibia, it is usually inclosed in loose cellular membranes, as if in bags, composed of smaller sacs. In the bones, where no motion is required, it is confined in still smaller cells. The fat is less, in degree, in the soles of the feet, palms of the hands, and in the breasts, or the paps, of many animals. In the majority of the cold-blooded animals we do not find any subcutaneous fat; but the inner surface of the skin is moistened, like the rest of the body, by an oleaginous fluid, as in the salmon; but the moon-fish has a substance like lard, of two or three fingers' breadth. The amphibia have their fat abundant in the abdomen; the majority having long, fatty, and membranous appendages, which are filled in autumn, and exhausted in the spring. In fowl, there is but little between the muscles, but some beneath the skin, and much within the abdomen, though not in so great abundance in some, as in others. Hunter says, that in the bones of the legs, toes, last bones of the wings, as also in the bones of the tail, there is a considerable quantity of fat, especially in the swimming tribe.

In ruminating quadrupeds it is very abundant, but especially so along the flanks, around the Kidneys, and in the neighbourhood of the udder. This deposition is beautifully arranged for the production of milk; this fluid being wholly a secretion from animal oil, and not from blood, as physiologists inform us.

Animals, in which the subcutaneous fat is very abundant, have the sensibility of the skin greatly diminished; and those that are not endowed with much hair have a considerable quantity of fat, and that more superficial than other animals.

The seal and the whale tribe have a large quantity of fat between the skin and the muscles, and but a small portion, comparatively, in the cavities of the body. In these animals the external fat is inclosed in a reticular membrane, apparently com-

[1] See Preparation, 1822, R. C. S.

posed of fibres passing in all directions, which seem to confine its extent, allowing it little or no motion in itself; the whole, when distended, forming almost a solid body.

This reticular net-work in the seal is very coarse; in animals which are not fat, when it collapses, it looks almost like a fine net with small meshes [1]. In the human subject it is very copious beneath the skin, perhaps more so in this region, than is found to be the case, in the same spot, in any animal.

I have before remarked, that fat undergoes material changes in the course of the lifetime of the animal. It is white and fine in character in the young infant, of a pale citrine in the adult, and of a dark lemon in old age. The same changes are observed in the young of animals generally. The channels by which the oil is carried from the main reservoirs in the body into the general circulation, are the lymphatics. In a whale that was caught in the mouth of the Thames, where he had been for some time, Hunter found several plexuses of vessels, some as large as a finger, filled with oil and spermaceti. These vessels are called, by this eminent physiologist, absorbents; but I should say they were strictly oil-ducts. However, the examination of hedgehogs and of the marmotte, both before and after winter, puts the question quite at rest. In the first examination of one of these animals in October, recently taken from the fields, Mr. Jenner found the brute exceedingly fat. There was a very thick layer of fat between the skin and the muscles on every part, except the head and legs. The caul had fat about it, but was not loaded with it. The Kidneys lay upon a large bed of fat, but had none of this substance upon their superior part. The thick layer of fat mentioned above, between the skin and muscles, lay very loose, and was but slightly attached to either. Another animal was examined in February. A thin layer of fat lay between the skin and external muscles, of a yellowish hue, not more than a third of the quantity observed in the first dissection. There was but a small quantity of fat about the caul and the Kidneys. In the stomach and intestines there was not the least appearance of food. The animal was found sheltered in a hollow place in a bank, and covered over with leaves. The place was carefully examined, and no kind of food was discovered about it. A third hedgehog was examined in March. In this animal the fat was nearly exhausted. There was not the least appearance of it

[1] Hunter on Whales. Phil. Tr. 1787.

about the Kidneys, caul, or in the abdomen. The whole quantity that remained was between the skin and muscles, and there it was in a very small proportion [1].

Prunelle investigated this curious subject with several hyemal animals, as the hedgehog, the bat, the dormouse, the marmotte, the bear, and the badger. But it was chiefly to the marmotte of the Alps that he confined his attention and observation [2]. During the winter's sleep of these animals, the pulse falls from 90, its ordinary range, to eight or ten pulsations in a minute. The inspirations are not more than three or five in a minute, and sometimes there is an interval of as many minutes before the animal is observed to recommence breathing. The fat is so voluminous throughout the body, immediately preceding their sleep, that the muscles can scarcely be traced. It is a singular feature in these hybernating animals, that the whole body is covered with an unctuous liniment, or varnish, which perfectly excludes the transmission of the perspiration. This latter secretion from the skin is, I am satisfied, a drain from oil, in all animals, and therefore a wondrous and wise God has endued these hybernating creatures with a power of secreting an unctuous covering, whereby the oil of the surface of the body is retained, and not allowed to escape in perspiration, for the sake of nourishing and warming the animal, during its sleep under a surface that is constantly covered with snow. As the autumn approaches, the various organs in the chest and abdomen undergo very striking changes. Beneath the breast bone, around the heart, and its investing membrane, within the lungs, &c. &c. the accumulation of fat is extraordinary. The thymus gland in the throat becomes so loaded with this animal substance, that instead of remaining in its usual position, over the throat, it reaches downwards into the chest, and is contiguous with the mass of fat around the heart, and is even continued down the spine with the larger blood-vessels of the heart, as far as the pelvis. On cutting through the skin and abdominal muscles, we find one huge layer of fat, extending over the whole anterior portion of the cavity of the abdomen. This layer is continuous with the one recently noticed in the chest. It passes round to the loins, and is united to the dense mass of fat in which the Kidneys are imbedded. Towards the month of March these depositions have nearly all disappeared.

[1] Hunter, Cat. of Mus. Royal Col. Surgeons

[2] Annales de Mus. d'Hist. Nat. tom. xviii.

The caul of the marmotte in autumn is very extensive, and is, in appearance, one thick layer of fat; but this membrane becomes so divested of its fat by the month of June, that Prunelle could then scarcely trace any caul in the animal. The stomach lies on one thick bed of fat, and has, moreover, this fat caul attached to its border. It is clear that the oil passes into the stomach of these hybernating animals, and nourishes them; for in all those that Prunelle, and others, examined, they found this organ filled with a white unctuous liquid, which was universally adherent to the walls of the stomach, although the animal had taken no food for three or five months. The blood is almost as dark in the arteries as in the veins. The blood-vessels throughout the body are lined, externally, with copious layers of fat, but this is especially the case with the numerous branches that go to the formation of the portal vein of the liver. The Kidneys, the spleen, and the liver are equally enveloped in thick layers of fat, as are other portions of the body. Besides the above-described masses of fat in hybernating quadrupeds, there are found in some, additional layers, or cauls of fat, that pass around the several intestines, and especially the small ones. These are, doubtless, intended to convey oil also, into the bowel, for the mouths of the lacteals to absorb, and so carry the nourishment into the blood, in the same way that the oil is carried into that vital fluid by other channels.

CHAPTER VI.

THE CIRCULATING ANIMAL OILS.

If any of my readers are disposed to doubt the fact that the accumulated oil of hyemal animals does circulate in appropriate ducts, and that it passes by these ducts into the blood, I would ask, by what channel, then, is it that the oil flows into the blood? All physiologists acknowledge that this oil is the sole nourishment of, and only source of food to, the animal during its five or six months' sleep; notwithstanding which, it is a matter of sur-

prise to my mind they have never attempted to point out the channels through which it flows. I must affirm, however, that this nourishment passes into the stomach and intestines of the animal by its own appropriate oil-ducts. This animal substance is there submitted to a slight process of digestion, which capacitates it for mingling and circulating in the blood. Now if this position be correct, we must conclude that the same processes of transmitting oil from the caul into the stomach can and do continue when the animal awakes; though it must be acknowledged to be so, in a less degree, inasmuch as the brute now takes in nourishment by the mouth. What becomes of the thick bosses of fat that are found platted in and around all the muscles of the dormouse and marmotte during the autumn? They are not to be found in the spring, and the animal, when dissected in April and May, is so lean, and free from fat, that it is almost incredible how so diminutive a beast could have stored away in its own body such a huge mass of fat. This subcutaneous fat, as well as the fat of the caul, kidneys, spleen, liver, &c. &c., passes into the blood by a similar set of oil-ducts. The celebrated J. Hunter could not have reconciled the doctrine of the circulation of oil with his absorbent system, consequently he misconstrued the experiments which Mr. Jenner made upon the hedgehogs at his request. He merely says, that oil nourishes an animal, "so that the reservoir of fat is begun upon whenever the nourishment falls short of the necessary quantity; and the animal becomes leaner and leaner[1]."

It is impossible to reconcile such an opinion with that eminent physiologist's doctrine of the absorbents of the body. If the absorbents carry away fluids from the blood, or from the solid parts of the body, as the bones, teeth, &c., then they cannot carry away pure, healthy, and life-affording oil. There must be two sets of vessels to perform two most opposite functions. But how the oil tends to nourish the animal, and by what channels it passes into the animal's frame, when it cannot obtain sufficient nourishment by the mouth, Hunter does not tell us; nor indeed does any physiologist since his time even hint at the mode by which this process is carried on. I have already said, I am convinced that the lymphatics of the body carry oil into the blood, hence I should term them oil-ducts of the body. That the absorbents are altogether a distinct class of vessels, and have

[1] Hunter, Cat. Mus. Royal Coll. of Surgeons.

nothing whatever to do with the previous set, the oil-ducts. The absorbents are spread over the whole body, and have two principal arms, mouths, or extremities. The one arm reaches over the whole skin, and the other is stretched over the whole intestinal canal. These vessels do not enter glands. The oil-ducts, however, do enter glands, usually, though not by any means as an invariable rule. But if I attempt to pursue this subject any farther, I must necessarily wander very much from the main points of interest in this work. Yet I must not conclude these few observations upon the oil-ducts and absorbents without apologizing for the cursory manner in which I have thrown out my opinions upon the subject.

If a gracious God should spare my health, my life, and my ability to study the subject, I may hereafter recur to it: in the meanwhile I would earnestly recommend those persons who are much interested in this branch of physiology to peruse a valuable work, now rather scarce, and which was written soon after the publication of Mr. Cruikshanks' treatise on "The Absorbent System." I allude to Benj. Humpage's "Physiological Researches." This author has anticipated me in many of the points concerning the absorbent system; and I cannot do better, now, than refer my readers to his highly-talented and most interesting work. I shall, therefore, conclude this part of the physiology of oil and fat, &c., by placing a few incontrovertible axioms in a subsequent chapter, and leave the reader to judge for himself, whether Cruikshanks' theory is a correct one, or whether a complete alteration in the modern physiological statements of the absorbent system is not called for.

PART VI.

CHAPTER I.

ANIMAL HEAT.

Whenever God the Holy Ghost, in His unerring revelation, would set before us the most vital and most nourishing portion of any vegetable substance, or the best part of a brute, He expresses it by the term, "oil" of the plant, or fat of the beast. Thus we read in His command to the Jews, that all "the best," or "the fat" of the oil, and all the best of the wine, and all the best or the fat of the wheat, that was offered to the Lord, were given to the priests as their portion. So, also, when the people offered any offering unto the Lord, "the best," or the fat thereof, was to be dedicated and given up to the Lord their God. (Numb. xviii.) From this revelation of God's mind and wisdom, we may learn that the best of a brute is its oil, for the life is in the blood, and the best part of blood is its oil; consequently, the very best part of a brute is its fat, or oil. What can be a more endearing, lovely, and precious feature in the holy character of a sin-hating God, than for a poor condemned sinner, who feels his own lost and ruined state, to see the mercy and grace of God in the face of Christ Jesus, our Lord, by whose blood we are cleansed from all sin? If we may presume so to speak with holy reverence, it was this attribute in the character of the eternal God which made Him to appear transcendently lovely, grand, and wise in the eyes of His elect angels. That a holy God should, at the same time, be a just God and a Saviour. This was grace, the highest feature in the Divine mind.

The fat of the wheat is elsewhere expressed by the Kidneys of wheat: the Kidney, therefore, ranks pre-eminent in man and in brute. It is the source of the beast's life, because it is the purifier of its oil, and oil is the current in which life flows, for

the blood, which is the life, is the most oily fluid in the system. But the Kidney is endued with more pre-eminence than this; for it is the source of animal heat, and it is embosomed in warm oil; oil being naturally a warmer medium than blood, so the Kidney is a much warmer body than the heart, as I shall shortly notice. Animal oil has long been considered a preserver of animal heat; but I do not find that physiologists have yet considered the mode by which this substance becomes a source of animal heat. I shall, therefore, proceed to give some important and most interesting facts connected with this point. But before I advance further, I may as well observe, that in the hybernating animals the renal fat is first consumed by the brute; and then the fat in the caul and abdomen are taken up; and, lastly, the subcutaneous fat, so that we may reasonably suppose that this last-mentioned fat is left unconsumed, as long as it is compatible with the life of the animal, and thus it is enabled to preserve its natural temperature. The pouring out of the fluid of animal oils in the way of perspirable matter is another source of exhaustion to the oil; consequently we find that wonderful phenomenon in these sleepers which I have adverted to, the whole skin, towards autumn, being covered with a glue-like fluid, which effectually precludes the transmission of perspiration, and serves to retain the oil for the nourishment of the animal. A diseased obstruction, however, produces a very different result; for the "plica polonica," or plaited hair, the disease so prevalent among the Poles, and many other complaints of this growth from animal skin, originate in obstructed circulation of the subcutaneous oils.

It is an undeniable fact, that in all those animals whose bodies abound in fat the temperature of the beast is retained longer after death than in those who die, or are killed, whilst comparatively lean. In other words, a very fat beast is much longer cooling than an ordinarily fat one. In some oxen the bodies do not arrive at the temperature of the surrounding atmosphere under fifteen hours, whilst in others the heat of the brute will vanish in half that space of time. The fact is equally well known to individuals long resident in public hospitals, as it is, respecting the brute, to butchers.

The bodies of persons in health, who are brought into these institutions with serious injuries which prove fatal in a few hours, do not partake of the temperature of the surrounding atmosphere under twenty-four hours. This fact is particularly marked with robust and fat individuals. But the bodies of those who die of a

lingering and emaciating disease, as consumption, become cold in six or eight hours.

In the healthy and fattest animal the circulating oils are in full play, affording heat, nourishment, and life to the brute; whilst in the lean brute the diminution of this vital fluid causes a corresponding diminution in their temperature. That this is a fact, I have no doubt; for I have attentively noted down, during a long period of time, the temperature of the blood of numerous cases of individuals within these walls whom I have bled from the arm. I have introduced the very small bulb of a most delicate thermometer over or within the orifice of the bleeding vein, and I have obtained the following results:—

The temperature of the blood of a robust person with pleurisy has been 100° or 101°. The temperature of the blood of cachectic pale young men and women, who were of very spare habits, and in whom the deficiency of muscular fat had given rise to a dirty white, or dingy skin, and labouring under recent pleurisy, &c., was 97° only.

The temperature of the blood in many other diseases was also accurately noticed.

In persons, previously enjoying robust health, with inflammatory attacks of the chest, or abdomen, the temperature was 100°, and above. The blood of those who laboured under passive diseases, as dropsy, cutaneous affections and disorders, in leucophlegmatic habits, presented a temperature below the natural standard, sometimes as low as 95° or 96°[1].

I have reason, therefore, to suspect, that an excess of oil, and a diminution of salt, circulated in the veins of those alarming cases of spotted fever, so prevalent and so fatal during the winter and spring of 1837.

[1] I have remarked, also, that the temperature of those who die with malignant spotted fever is retained for an unusual period of time after death. In a corpse of one who had died with this disease the surface of the body was 72° eighteen hours after death, although it had been, during fifteen hours, on a stone floor in a room of the temperature of 50°. The blood was black, and still fluid, and had not formed a clot in any part of the internal organs. The same observations were made on most of the other fatal cases of spotted fever.

CHAPTER II.

ANIMAL HEAT.

The subject of animal heat has occupied the attention of physiologists from the infant state of medicine to the present hour. It is not clearly set forth to this day, and the various authors who have come forward to promulgate one doctrine, have drawn against themselves an equally large number of opponents; and animal chemistry has contributed largely towards the elucidation of this branch of physiology, and many of the old and abstruse notions of our forefathers have made way for the scientific discoveries and explanations of the modern writers. But we still find, that there is no agreement of opinion amongst the present physiologists, concerning this wonderful process in the animal frame.

The generation of heat in all bodies and its degrees, are explained by three general axioms:—

1. The more dense the matter, the greater proportion is the degree of heat; for, two bodies moving with an equal degree of velocity, produce effects in a direct proportion to their respective densities, or quantities of matter.

2. The greater the mutual pressure is of the parts of one body upon those of another, the heat generated is likewise proportionably the more intense.

3. The denser bodies are, the stronger is their mutual pressure; and the quicker are their motions, the greater is the degree of heat produced. Thus, the thick, oleaginous, and rich blood of a robust man, is more dense than the thin blood of a delicate habit, and spare frame of body. The mutual pressure of the globules of the one is much firmer and stronger than that in the other. The motion of this vital fluid is more vigorous and rapid, than is that in the thin, spare individual.

Oil, muscle, and blood, are found abundant in stout individuals; hence, they are of a warmer temperament of body, more

liable to diseases of an inflammatory character, and retain, as well as generate animal heat, better than those with a languid circulation and of a delicate structure of body.

For it is obvious, that lax and feeble habits of body cannot generate animal heat in the same degree that fat and robust persons do. Their circulating oils are more scanty; the fluids of the body less dense; and the motion of the various globules of oil and blood is languid, consequently, their attrition on one another is likewise weak.

Aristotle was acquainted with this fact, for he remarks, that "Blood too much diluted with serum is colder than the blood of those animals that have gross thick fibre[1]."

For the mass of blood not only consists of red globules, such as come more strictly under the denomination of blood, but also of serum, in which these globules swim; and the larger the quantity of serum, the thinner and the colder is the mass of blood, and vice versâ. Because the thinness of the fluid does not allow a strong and vigorous attrition of its particles, and the weaker this attrition is, the smaller must be the degree of heat generated, therefore, the thinner the blood is, the feebler is the heat produced[2].

Hence, the reason that hardy, robust people, who have their blood-vessels filled with a thick, rich, and oily blood, are more the subject of inflammatory attacks and active diseases than those of lax constitutions, whose blood-vessels contain a thin, watery, and much diluted blood. There is a principle inherent in all animals and vegetables, that enables them to resist cold, heat, and putrefaction. This is not dependent upon any property which they have of evolving caloric, for cold-blooded animals, and those whose blood is oxygenated by means of water passing into their bodies, as in the frog, turtle, and some insects, as the holothuriæ and molluscæ tribe,—these creatures possess the property of resisting cold to a much greater degree than those animals that have warm blood; and it is more perfect in them than in vegetables, or warm-blooded animals. This principle resides in the oil of the plant or seed, and in the oil of the animal or egg. This oil in the plant resides in its sap chiefly. The sap when removed from the vessels of a tree will freeze at 32°; and yet, trees are often found as low as 15°, and the sap is not frozen.

[1] Lib. ii. De Part. Animal.
[2] Consult Boerrhave, Instit. Medic. sect. 223.

If an egg taken from the nest, which usually ranges from 100° to 103° in temperature, is put into a cold atmosphere of 15°, it will take half an hour to freeze; but when thawed, and put into a cold of 25° only, it will freeze in half the time. Thus it appears, that the life of the substance resists a decrease of temperature below a certain point[1]. So if blood that has been frozen and again thawed, be put with fresh blood, and again frozen, that portion which has undergone this process will freeze much faster than the fresh blood[2]. Hunter took the juices in the flesh of animals immediately that they were knocked down, and froze them, and again thawed them, when they evinced the same life that they had before. The life of the blood, I apprehend, resisted its enemy, cold, and preserved the part from death.

If we take a fish out of the sea, the heat of its body, being perhaps, about 60°, and bring it into an atmosphere of 70°, the blood on being let out of its vessels will immediately coagulate[3]. This fact Hunter ascertained on board of a ship lying off Belle Isle; for immediately upon a fish being caught, he ascertained its temperature, and letting out part of its blood, it immediately coagulated, although the blood so discharged was become warmer than that remaining in the vessels of the fish, which still continued fluid. A diminution of temperature, therefore, has no influence over the coagulation of blood.

CHAPTER III.

ANIMAL HEAT.

I HAVE stated in the earlier pages of this work that the Kidney is the hottest part of the body, and that its nature is to thrive in unctuous warmth, and by its wonderful mechanism, and internal action, to produce heat for the animal body. It must be remem-

[1] Hunter, Philos. Trans. vol. xlviii. [2] Currie, On the Vitality of the Blood.
[3] Hunter, On the Blood.

bered, that animal oil out of the body, requires a temperature of 120 to 150 to render it fluid. The blood of all warm-blooded animals is never higher than 100°. If, therefore, animal oil circulates within the bosom of the Kidney, as most certainly it does, it must have a proportionable temperature to keep it sufficiently liquefied for such circulation. The mean temperature for this important action in the oil of an animal, I shall put down at 107° to 110°, which is pretty near the exact average. It must appear most reasonable, therefore, that if the Kidney is literally imbedded in oil, both within and without its bosom, and that if the oil is more copious around this gland than around any other parts of similar dimensions, that therefore this gland in the healthy and living body must be proportionably hotter than any other part of the animal.

But I shall proceed to give my readers the results of several often repeated experiments upon sheep in the slaughter-house. The first series of experiments was made in April. The temperature of the slaughter-house was 45°. I was provided with one of the most delicate thermometers it was possible to obtain, and the bulb of it was probe-pointed, so that it could pierce its way instantly into meat, oil, or glandular substance.

Experiment 1.—At two minutes to four, P. M., a fine wether sheep was stuck. It was dead as the clock was striking four. Five minutes after four the fleece was removing. The thermometer raised to 95°, was passed over the raw surface of the carcase; it ran down to 93° and 90°. Eighteen minutes from its death, the belly was open. I plunged the thermometer at 96°, into the body of one Kidney, it rose instantly to 102°. It was taken out, and plunged into the oil-bag; it ran down to 98°. The other Kidney was pierced, the thread ran up to 102°. The centre of the liver was pierced, then the spleen, the thread in each stood at 98°, not a shade of difference between either of these glands. The heart when pierced was 100°.

The whole experiment was made in one minute and a half.

Experiment 2.—Another beast was stuck at twenty minutes past four. The blood clotting in the tub was 98°. The raw surface of the carcase was 92° and 90°, in ten minutes from its slaughter. In twenty minutes from the time it was stuck, the thermometer at 96° was plunged into one Kidney; the thread instantly rose to 102°. It was placed in the omental fat, it ran down to 98°. The other Kidney was then pierced, the thread ran immediately up to 102°. The oil-bag was then tried, in two

spots it was 100°, and in one other spot 99°. The liver, spleen, and heart, exactly as in Experiment 1.

Each Kidney, in these two beasts, was pierced twice; so that eight trials were made in the two, and there was not any appreciable difference in temperature. The whole eight evinced a temperature of 102°. The oil-bag was pierced as often, and varied from 98°, 99°, and 100°; but never above.

Another batch of beasts was slain a short time after the foregoing experiments were made, when I again tested the several points already alluded to.

The man observed, that when the beasts had been kept four or five days in the slaughter-house, they were longer than others in dying; and such was the case in this batch. The temperature of the room was the same as at the last visit.

Experiment 3.—The wound in the neck directly after it was made, was 102°. The blood as it flowed from the wound was 100°. The sheep cools in four or five hours. Four minutes from the period of sticking this beast, and when it was quite dead, I plunged my hand through a small opening the butcher allowed me to make, between the pit of the stomach and navel, into the hot cavity of the abdomen. My hand grasped the Kidney, and, with the other hand, I guided the thermometer at 96° along the palm, and pierced the gland. The thread instantly ran up to 102°. The other Kidney was then grasped and pierced, the thread stood at $101\frac{3}{4}$°. The omental fat at 99°. The liver at 99°, and the other organs as before.

I repeated this experiment several times upon other sheep, and at the same period of time after death, as in the last instance, when the results were the same. I had some reason to suppose, that as the animal cooled, the heat of the body might be driven inwards upon the large organs of the body, but the last series of experiments completely set aside my suspicions, and satisfied my mind that the temperature of 102° was the degree of heat in which the Kidneys act, whilst 99° or 100° was the heat of the heart, and 98° the heat of the liver, spleen, &c.

It might be a matter of surprise, that the animal oil did not present a higher temperature; but when we consider the rapidity with which this substance cools, and the fact, that the portion of oil distant from the Kidney is never so liquid in the living body as that close to or within the Kidneys, and, therefore, that it has less heat within itself; we shall readily understand the apparent discrepancy in the temperature of the oil, and that of the Kidney.

From some conversation I had with the master butcher, I had reason to believe, that as soon as the beast begins to sicken after its admission into the slaughter-house, that some important changes take place in the animal, which I shall proceed to notice.

When a flock of sheep are driven up from the country pastures to this metropolis, they are but scantily supplied with food; for if the graziers allowed them much fodder, the fat would be injured; that is to say, the intestinal fat would be so soft and thin, that the butcher could not derive all his profit from the sale of the suet; neither would he be able to draw it away from the various parts of the animal.

When the beasts are housed for slaughter, they are allowed but a scanty feed of hay and water. In the course of two days they begin "to fret in their loins," as the butchers express it, and to get thin about these parts; they refuse hay, and look heavy and dull. If the animals in this state are not soon killed, or turned out to grass, the meat will be seriously injured. I conclude, therefore, that within twenty-four hours after being housed, they diminish in degrees of animal heat; the Kidney-oil begins to be a source, and, perhaps, the sole source of nourishment, just as it feeds the hyemal animals in winter. The temperature then rises one or two degrees for a day or so, and then falls again to the temperature of its first state, when brought into the slaughter-house.

In May I made the fourth trial upon a very thin and flabby sheep. I expected to find the heat of the various internal parts lower than in the preceding experiments, as the former beasts were very fat and bulky. But I had not the gratification of such a result. The thermometer at 86° was plunged into the right Kidney. The thread rose to 102°. In the left Kidney it rose to 101°. The liver was $99\frac{1}{2}$° ; the spleen, 98°. The fat and the Kidney oil-bags were $99\frac{3}{4}$° and 100°. This animal had commenced "fretting in the loins," and the Kidney oil was its source of nourishment. The heat of the beast rose one or two degrees, as I have already remarked, and would doubtless have sunk again, had he been allowed to live two or three days longer in the slaughter-house.

Towards the latter end of May, I again visited the house, and was present at the killing of some fine wether sheep, the Kidneys were 101°. The liver 99°. They had been brought in the preceding day. The wound in the neck was barely 100°.

CHAPTER IV.

ANIMAL HEAT.

After I had made the preceding experiments, and had obtained the results I have now related, I was desirous of ascertaining what appreciable difference of temperature was to be found in the renal regions of those persons who were labouring under some disease of the Kidneys. If the peculiar internal actions of these glands are the source of a greater degree of temperature within them, than is to be found in other organs, it is more than probable that a deficiency, or derangement, in these actions will be productive of a diminished temperature. But we have one difficulty to encounter in this part of the investigation; we cannot lay hold of the Kidney in the living, although it be the diseased body, and all our experiments upon this point, therefore, must be confined to the surface of the body—the renal regions.

Before I proceed to the narration of the several instances of diminished temperature of the Kidney, in consequence of disease of this gland, I may here notice, that whenever there is unequivocal signs of the disease of the Kidney, the animal temperature will be considerably diminished. The blood is two or more degrees lower than in health, and there is an absence of fibrinous or gluey matter, in this life-giving fluid. Various parts of the body, as the surface of the chest, the arm-pits, and the ham, will present a temperature three or five degrees lower than in a robust individual.

I took four unequivocal cases of diseased Kidney; in all of them the urine was of a very low specific gravity, averaging 1·106°. This secretion was limpid, and almost colourless. The renal regions were examined whilst the patients were warm in bed, and the whole four did not evidence a higher temperature than 93°, though the arm-pits were 96°. In one instance, of a young man, whose left arm was paralysed, the temperature of the sound limb was 87°, the palsied one 83°. The renal regions

88°. The region of the heart 90°. This person had been walking about the ward rather briskly just before I made the experiment. I have no doubt that the oils of the Kidney were diseased in this man, and that this affection had been brought on by extreme anxiety and distress of mind; but as I shall have occasion to speak more at large upon this point, and of the connexion subsisting between diseases of the Kidney oils and paralysis, under the head of diseases, I shall pass on to the other observations made upon diseased Kidneys.

In the case of a man slowly convalescing from acute rheumatism, the Kidney was 95° in temperature; the axillæ 98°; whilst in a man labouring under an abscess of the left Kidney, in which inflammation of the surrounding parts was actively going on, the temperature was 91°; the right or healthy one was 89°. The heart was also 89°. He had lost fifty pounds and upwards in a few weeks, as we ascertained by weighing him on several occasions. His skin was always dry, and harsh to the touch, not unlike to a diabetic person. We may observe here, that a change in the character of the urine is a sign of the increased or diminished temperature around the Kidneys.

Those individuals who are habituated to a life of ease and temperance, preserve a moderate degree of heat, and secrete a fainter and less saline urine, than those who indulge in excesses, whether it be in eating or in drinking, and who are habituated to tedious exercise [1]. Indeed, most persons are aware, that a rapid pulse, a hot skin, and high-coloured, and very saline urine, are so many signs of internal fever; but there are few who know, that pale and clear urine, with little salt, and a lax fibre of body, with cold feet, denote an internal sluggishness of the circulation of oils within the Kidney. That condition of body, which presents a medium in these two extreme symptoms, is the healthy average.

But it is now time that I should at once state my views of the principal cause or source of animal heat. It must be remembered, that wherever carbonic acid is formed, heat is generated; and this acid is not merely formed in the lungs, but over the whole texture of the body, wherever arterial blood becomes venous: in short, this heat is principally formed in the capillary system of vessels. Carbon has an extraordinary avidity for oxygen, and, by its combination with this gas, produces carbonic acid. Carbon,

[1] Hoffman, Med. Nat. Syst.

then, forms the great bulk of animal matter. Now oil is a substance containing a very large proportion of this animal matter. One of the essential principles in venous blood is oil in excess, as contrasted with arterial blood. One of the essential principles, however, of this latter portion of blood, is oxygen in excess. As soon, therefore, as arterial blood arrives at the minute arteries, a fresh addition of oil, from the subcutaneous fat, or from that universal texture of the body the adipose membrane, is supplied to it; venous or carbonized blood results, carbonic acid is formed, and heat must be the necessary consequence. Whatever, therefore, tends to accelerate this process, tends likewise to increase the heat of the body; such as strong exercise, ardent liquors, and spicy viands, &c. Hence the rapid pulse, and the glow of heat, or the languid circulation, and the cold extremities, are co-partners. A nicely balanced action of the heart and arteries, a due separation of healthy rich oil into the veins, and a quiet, regular, and free expansion of the chest for good air, constitute principles for health. It is owing to this chemical change in the blood through the extreme vessels of the body, that a sufficient quantity of heat is evolved, whereby all warm-blooded animals are enabled to maintain their natural standard of heat, when they are surrounded by an atmosphere much colder than their own bodies. But I am persuaded, that there is some peculiar difference between the cellular oil of the adipose membrane of the body, and that oil which we call suet, around and within the Kidneys. The one is known as suet, the other as fat, in the brute carcase. This chemical difference, whatever it be, for I do not find that chemistry has unfolded this matter, produces a dark colour in arterial blood when this fluid gains oil, although it was red just before, with its own oil. Arterial blood, I suspect, possesses oil as fat, with an excess of oxygen, whilst venous blood possesses both oil, as fat and suet, with an excess of carbon. Arterial blood does not coagulate like venous blood.

But it must be acknowledged, with deep humility, before that eternal and infinitely wise God, that there are mysterious depths in the marvellous phenomena which this life-giving fluid presents that are wholly beyond our finite comprehension; in the contemplation of which, and in comparing these mysteries with what we are permitted to know of a God such as He is, we can say with His servant, "We are but of yesterday, and know nothing." Job viii. I would here notice some of these inexplicable facts with regard to "the life" of the blood. If this fluid be taken

out of its living vessels at 60° or 65°, as in the first tribe, it will immediately coagulate even in a much hotter atmosphere. "The life" departs, and the fluid becomes a solid. If it be taken from an ox, or from the human subject, at 98°, and put into an atmosphere colder than itself, life again departs, and the solid clot is formed. So the blood of each animal has a principle of life within it, which departs when the vehicle in which this life resides is removed from its natural channels, and is brought into contact with our atmosphere. This life, or vital principle in blood, endues it with the property of forming vessels in, and of itself, under necessary circumstances. For a coagulum of blood, or coagulating lymph in an animal body, has the principle of life in its composition, so that it soon opens a communication, not only with the surrounding vessels, but even with the mind itself, forming within its bosom nerves as well as blood-vessels[1].

CHAPTER V.

ANIMAL HEAT.

Notwithstanding the great advances made in the present day in animal chemistry, yet we still find that physiologists cannot make up their minds upon some interesting points connected with the blood. Some authors assert, that arterial blood has less capacity for heat than venous; but there are others who oppose this statement, and afford very excellent reasons for their objections. I should say, without entering minutely into the subject, that that blood which contains most of animal oil must necessarily be the warmest.

Dr. Crawford thought that venous blood had less capacity for heat than arterial. He allowed, however, that the conversion of arterial blood into venous produced caloric. Drs. Davy and Black refuted the first author's opinions on many points; and Dr.

[1] Hunter on the Blood. Stevens on ditto.

Davy asserts that he found the heat of the blood in the jugular vein one and a half degree below that in the carotid[1].

Dr. Stevens has more recently refuted the ungrounded opinions, founded, as they were, upon the unsatisfactory evidence of Dr. Crawford's experiments. This able physiologist clearly proves that venous blood has a greater capacity for heat than arterial. "For when an alkaline oxide is converted into an alkaline carbonate, its capacity for caloric is increased. If we dissolve an alkaline oxide, heat is immediately evolved, and the temperature of the water rises, during the solution, several degrees higher than it had before. When carbonic acid is added[2] to the circulation in the extreme texture, the capacity of the blood for caloric is also increased, and a part of the heat which is evolved by the union of the oxygen with the carbon is absorbed by the venous blood, and retained in a latent form, until the acid is removed by the lungs. The latent heat is then evolved, and this is sufficient, not only to heat the cold air in the chest, but also to raise the temperature of the arterial blood from one to two degrees higher than it had been before[3]."

Some months had elapsed after I had investigated the anatomy of the Kidney, and had ascertained the reasons why the oil did not pass up into the gland beyond the semicircular oil-tubes; and the period at which it was made clear to my mind, that the operation of secretion, or drain from oil, went on above these semicircular oil-tubes; and that below, and within them, the processes of oil-lubrication and anointing were carried on, in order that nutrition, life, and health might be imparted to the blood, at the same time, that the various passages were protected from the acridity of the renal secretion, by the oleaginous fluid poured out over their surfaces. Hence I was led to reason thus:—

First, blood is the agent of animal heat, and animal oil enters largely into its composition; therefore animal oil is essential to animal heat.

Secondly, the Kidneys are organs that preserve the health or purity of animal oil; hence the Kidneys are essential in the production of animal heat. For in the bosom of this gland not

[1] Phil. Trans., 1814.

[2] The carbonic acid is never *added* to the blood, but the carbonic acid is generated because OIL is added to the blood.

[3] Stevens on the Blood.

The last passage is the only reasonable explanation I have ever met with towards the solution of this curious phenomenon.

only is oil purified, and drained, but the grand communication between oil and blood takes place through the medium of the renal vein. If these reasonings were correct, I ought to find the Kidney a hotter part than any other organ in the body. For if oil requires more heat to render it fluid, and thus fit it for circulation, than the blood into which it flows, then there must be an alteration of temperature on the two being combined, just as there is a rise of two degrees in the change of arterial into venous blood on the surface of the body, or of venous into arterial blood, as in the act of inspiration. Both actions are vital, and not chemical. I mean, so far vital that human wisdom and physiological research have not hitherto fathomed the difficulty, because authors have considered it in the light of a purely chemical action.

By the details of the experiments related in the former chapter, the reader will be enabled to judge how far my views were correct upon this point.

I cannot leave this interesting subject without expressing my surprise at the carelessness and inattention with which physiologists and chemists in this country have passed over the subject of ANIMAL OIL; for with the exception of the valuable remarks of Hunter, and one or two other authors, there is not a sentence offered in the modern works of anatomy upon this highly-important animal substance. It would form a most useful inquiry for the medical practitioner, and which chemistry ought long since to have replied to—Are the human oils all different? We know by the appearance, feeling, and consistence, that the joint-oils of a bullock's haunch, shin, and hock are three different fluids, though they all answer the same end, and are all of them oils in the highest state of purity, blandness, and delicacy, for the lubrication of those wonderfully-constructed parts, the cavities of joints. I am persuaded that in proportion to the smallness and delicacy of the joint, so is the subtilty and thinness of this animal oil; the oils, for instance, of the heels of a brute are much finer, thinner, and transparent, when seen out of the body, than the like fluid, taken from the larger and stronger joints. We know that the oil of the two Kidney-bags is different in composition to the joint oil: the former is suet and oil; the latter, most probably, has but little, if any suet in it. In like manner, the warm oil of the Kidney oil-bags differs materially from that oil which is within its semicircular tubes in the interior of the Kidney. The oil-bags are, therefore, two separate reservoirs,

and, consequently, may, do, and must vary, by circumstance, one from the other, as from disease, change of diet and climate, &c. &c. They are, therefore, oils of different characters from the joint oils of the human limbs. These latter, again, differ in a remarkable manner, I doubt not, from each other; for as we find some joints and their oils affected with peculiar diseases, which others are not liable to, I must conclude that this difference has not a constitutional origin, but that it arises from a difference in the character and quality of the oil of the joint: thus we suffer from gout in the toes and hands, but never in the elbows and knees. Again, we are liable to rheumatism of the knees and elbows, but not of the small joints of the fingers. Gouty concretions form around the joints of the hands and feet, but rarely do so around the large joints. How uncommon, on the other hand, is an acute rheumatic swelling of the hip or shoulder-joint; but how common is it to see the knees, elbows, and wrists stuck fast and locked with this painful malady. From these remarks it will not surprise me if, at any future period, there should be found twenty or thirty oils in the human frame, all differing from each other in their chemical composition, as they are now seen to differ in their physiological designs and purposes; and if an intelligent and experimental chemist would take up the subject, I have no doubt that he would be amply rewarded in his labours, and that he would confer a great benefit upon the physician and surgeon, as well as upon suffering humanity.

Looking, therefore, at the two varieties of animal oil, the one above and around glands, as the oil of the Kidney, and some of the smaller glands; and the other, the oil of joints; we might take up this one peculiar feature of their character, and make it the grand division of the whole. I mean the glandular oils, and the non-glandular or joint oils. The Kidney is not the only reservoir for the CIRCULATING oils; but we may call it the fountain-head and reservoir of these fluids: other glands might be reckoned as so many smaller rivulets that make up the great river. We may safely rank the glands of the lacteals, which sift and sieve the oily chyle before its admission into the main duct, as some of these rivulets, or lesser reservoirs; what the glands in the neck, arms, &c. &c., perform in the office of the circulation of animal oil I have not yet made out satisfactorily. Let this stand, then, as the first division of the animal oils. 1st, CIRCULATING GLANDULAR OILS, and, 2nd, LUBRICATING JOINT OILS, which, of course, do not circulate through the system in any way

analogous to the first set of oils. I should infer, also, that the temperature of the joint oils was lower than that of the Kidney oil, though higher than the muscle surrounding the joint. I dare say the former is 100°, whilst the flesh of the part ranges at 97° or 98°; for the Kidney embedded in its oil is 102°, whilst the heart is only 98° [1].

There are two principles in blood essential to its colour and vitality; and these two are oil and salt. Whenever one or both of these ingredients in animal blood becomes diminished in quantity, or altered in quality, the property of the blood to carry on life, nutrition, and health becomes enfeebled; the heat of this fluid, and, consequently, of the whole body falls, and the animal sickens. But an excess of one or both of these substances in blood is likewise injurious to the health of the animal. "When an excess of saline matter is taken into the stomach, the greater portion of it passes directly to the right side of the heart [2]," through the medium of the roots of the portal vein. The patient becomes restless, hot, and dry in his lips, and if the excess of saline matter is not carried off by the skin and Kidneys, the result may prove very distressing to him.

"If salt be mixed with blood just about to coagulate, the moment the fibrine feels the stimulus of the salt the whole of it suddenly becomes solid; and I have seen this effect almost as rapid as the contraction of the muscular fibres in the living body [3]." The use of salt, therefore, too long persisted in, renders the blood fluid, stimulating, and thin; the oil becomes deteriorated, and the fluid blood becomes so acrid to the coats of the minute and delicate blood-vessels of the body, that it escapes from them in the form of stains or petechiæ; scurvy, purpura, spongy gums, &c. are the result.

In the tropical dysentery of sailors the abuse of salt has destroyed the healthy character of the blood; the arteries could no longer secrete fat; the caul was not furnished with any oil;

[1] The subject, as I have several times stated, is in its infancy. Yet must I throw out in this place my opinion: as an opinion, nevertheless, based on certain appearances connected with experiments I have made, that somewhat similar tubes to those presented to view in the frontispiece which I have named feathery oil-tubes, or, perhaps, I might have called them "glandular feathery oil-tubes," will be found as the nucleus or pulpy foundation for, and wrapped up in, the muscles also, in which case they might be termed the "muscular feathery oil-tubes." I leave this point, however, for further examination.

[2] Stevens on the Blood.

[3] Stevens, ibid.

the liver no longer received rich oily blood for bile; and the secretions from the alimentary canal becoming disordered, the skin, having lost its subjacent fat, turned to a dirty white, or sallow hue; and the individual has presented a woful picture of disease and of bodily distress.

But I must pause here, for I find myself travelling into a subject which it is my intention to pursue under a separate head; and I shall now hasten to conclude this interesting question of animal heat, that I may at once pass on to the next head, that of salt, or ANIMAL SALT.

PART VII.

CHAPTER I.

SALTS, ALKALIS, ACIDS, &c.

THE various inorganic bodies which creation presents upon our globe may be ranked under four general heads: 1st, earths; 2nd, salts; 3rd, inflammable bodies; and, 4th, metals and their ores.

Our present interest will confine me to the second head, that of SALT.

There are three conditions in which salt is found in the earth. Mineral salt, rock, and sea salt. The latter is the most important in this treatise, and is known as common salt, muriate of soda, or chloride of sodium.

The term salt I should, however, first observe has a more general acceptation amongst chemists. This term is applied by them to any combination of a metal, or its oxide, with a gas, or an acid; thus we have chloride of sodium, or common salt, and nitrate of mercury, &c. &c.

The universal presence of this extraordinary agent, both in the animal and vegetable kingdom, at once stamps its great importance. The consideration of the salts, as they are formed in the Kidney, or extracted from the blood, must come under review; and here I behold so wide a field, that I am almost lost as I contemplate its vast and varied features.

Chemists reckon no less than twenty-one substances set free by the Kidneys during its healthy operations. Ten of these substances are salts in various proportions; five are acids, and the remainder, water, earthy and animal matters [1].

As the Kidney is a gland secreting its fluid from oil and blood,

[1] This *animal matter*, so called by chemists, is wholly a fluid drained off from the oil of the Kidney, as I have elsewhere remarked.

and as we find both oil and blood are strongly alkaline, it will not be surprising to find a predominance of alkaline principles in the urine. Thus there are seven salts of the ten that have alkaline bases; the remainder have earthy bases, which earths have all the properties of alkalies, and present alkaline agencies when mixed with water. One of these is lime, the chief constituent of bone, and a component part of oil; another is magnesia.

Of these ten salts, three are found in the earth, and are common to inorganic matter, as phosphate and fluate of lime, and phosphate of magnesia; three others have a basis peculiar to animal matter, ammonia; and the remaining four salts may be properly called vegetable salts. The earth, lime, appears to preponderate; then follows ammonia; and the vegetable salts are the least in bulk in this secretion; and I cannot doubt but that they are reserved for the important purposes of circulation in the blood.

The following is the best analysis of the salts, and other component parts of the urine of the human subject:—

1. Lime, phosphate of	Earthy salts.	13. Uric acid . . .	Acids.
2. fluate		14. Benzoic ditto .	
3. Magnesia, phosphate		15. Acetic ditto .	
4. Soda	Alkaline salts.	16. Urea,—the base of uric acid, a substance highly oleaginous.	
5. sulphate . . .		17. Silica	
6. muriate . . .		18. Gelatine	
7. Ammonia, phosphate		19. Albumen	
8. acetate .		20. Sulphur	
9. muriate .		21. Water	
10. Potash, sulphate .		22. Iron.	
11. Phosphoric acid .	Acids.		
12. Fluoric ditto . .			

It will readily be seen, how diversified the composition of those distressing formations, known as renal calculi, or stone, may be. The earth, lime, or the animal substance, ammonia, more commonly forms the bases of these concretions; the nuclei of which, are first concentrated in the vascular substance of the Kidney, and from thence they work forwards and downwards into the urinary ducts, pelvis, and bladder. Some of the bases of calculi are, I have no doubt, derived from the crystallizable principle, or "margarine" of animal oil. But my present enquiry leads me more particularly to the consideration of the various saline compounds, commonly called salts. These bodies consist of a numerous class. Thus there is the salt of minerals, the salt of vegetables, as that from grass, kelp, and barilla; and the salt of animals, as phosphate of ammonia, &c. These all preserve the animal, vegetable,

and mineral kingdoms, from decay and putrefaction; whilst a diminution of this salutary ingredient is quickly followed by disease, disorder, and confusion.

The universal presence of salt in the ocean preserves the mass of vegetable matter which it contains from putrefaction; and as the process of decomposition would be disposed to occur sooner under a hot and vertical sun, so we find, from the observations of some eminent men, that the nearer we approach the equator, the more remarkably does sea-salt increase; for a pint of sea-water in the Mediterranean contains an ounce of salt, whilst the same quantity taken from the Baltic contains only half an ounce.

A salted land, in holy writ, was a barren land, given up to a curse and a desolation; but a proper quantity on the land was a blessing, and rendered it fruitful. This information we gather from God's sacred word, where we find that the cursed cities, or those, that by their rebellion and sin had incurred God's just indignation and wrath, were sown with salt; as Sodom, Gomorrah, Admah, Zeboim, and Shechem. As the judgment of God overtook wicked Hiel for rebuilding the cursed city of Jericho, so did Jeroboam suffer a just punishment at God's hand, for rearing Shechem, and dwelling on the cursed land.

Our blessed Lord declares, that "salt is good." Salt in moderation, and not in excess. It was but a pinch of salt that the prophet Elisha cast into the foul waters of Jericho, and the Lord was pleased to heal those waters by the hands of His servant.

This substance is so essential to the health of animals, that, under peculiar circumstances, it has been ascertained by Dr. Prout, that they possess the power of generating certain salts, independent of the supply they receive from their food.

It is said, concerning the wretched infant, a type of the natural and graceless man, that "thou wast not salted at all." Grace had not touched thy stubborn heart, and oil had not mollified thee. "None eye pitied thee, to do any of these unto thee, to have compassion upon thee; but thou wast cast out into the open field, to the loathing of thy person, in the day that thou wast born." (Ezek. xvi.)

But the value and importance of salt, as a condiment, cannot be better shown than in its effects upon animals. "During severe winters, in the northern parts of America, the farmers can only preserve the sheep by giving them large quantities of salt; and, at this period, the natural craving for salt is so great, that even the wildest become perfectly tame to any individual who has

once supplied them with this article, and they attempt to follow him wherever he goes. When not given, many of them die; but when supplied, they are able to resist the most intense cold. Some wild animals, at certain periods, frequently risk their lives on purpose to drink the waters of saline springs, and can scarcely be deterred from this act, even by the presence of human beings [1]."

When common salt is applied to the wound of an animal bitten by a rattle-snake, it is a complete antidote against its poison. The animal bitten usually dies under this reptile in twelve or fifteen minutes; and the cause of death, in the opinion of Dr. Stevens, arises from a destruction or death of the vital principle of the blood: for one rabbit died in three minutes and a half, and it was found, on examination, that the poisonous fang had pierced a vein of considerable size. When an Indian is bitten by a snake, he applies a ligature above the part, and scarifies the wound to the very bottom, he then stuffs it with common salt, and after this it soon heals, without producing any effect on the general system [2]. In like manner, we may affirm, that no sooner had the serpent poisoned Adam, and his race, than the salt of grace and mercy in CHRIST the LORD, healed him.

It strikes my mind very forcibly, that if the same simple process was to be adopted in the case of a bite from a rabid animal, as the Indian adopts when bitten by the rattle-snake, that the awful and melancholy disease of hydrophobia would not supervene; nay, more than this, I should anticipate much benefit from the early exhibition of salt, either injected into the veins, or taken by the mouth, when the disease had manifested itself; and my opinion is strengthened by observing that, in the year 1790, some cases were treated in St. George's Hospital with a bolus, into the composition of which salt-petre largely entered, and they all recovered. The description given of the symptoms leaves no doubt that they were genuine cases of that fearful malady [3].

[1] Stevens, ibid.

[2] B. Gale, New England. Phil. Trans. abridged, 1765. Vol. xii. p. 244.

[3] Vide Phil. Trans. for 1790.

CHAPTER II.

SALTS, ALKALIS, ACIDS, &c.

It was a custom among Eastern nations in making a covenant to use salt; hence we find, that to this day, the Abyssinians, as Bruce relates of them, consider the act of a stranger eating salt with them such a mark of friendship, that no harm or violence happens to those who thus enter into amicable terms with them by partaking of their salt. But that spiritual salt, with which all other kinds of salt are not to be compared, is possessed only by the Christian. "Ye are the salt of the earth," says our Lord to His disciples. But what is this salt? Without doubt, it is God in Christ, by the Holy Ghost, who employs His own word as the primary instrument, and His faithful people as the secondary instruments; that this heavenly salt, or God's holy doctrines, may be sprinkled abroad, and disseminated throughout a dark and benighted world. Every man must be salted with God's sovereign, unpurchased, and unpurchasable grace, or with His wrath. The wicked shall be eternally "salted with fire," or the wrath of God; and the sacrifice of them shall be salted with salt.

But the various uses of salt are truly astonishing, and past reckoning; but thus much we may affirm of the heavenly salt, that, as fallen man is unsavoury, sensual, and devilish, before a Holy God, so he will remain till he is seasoned with the salt of heavenly doctrines, and the grace of God the Holy Ghost. For this excellent salt, unlike to that other salt, which only keeps flesh from putrefaction, but cannot render putrid meat sound and sweet, makes a corrupt soul uncorrupt for time and for eternity. The Christian, therefore, is bidden to retain saltness in all conditions and estates. "Have salt in yourselves, and have peace one with another," says the Lord. "While the enemy is sowing tares," observes an old-fashioned Christian of the Reformation period, "be you sprinkling salt; while others are throw-

ing bones of dissension, be you fastening the bond of brotherly union. For Christians should imitate Simon, dean of Lincoln, who being called to court, and becoming a favourite of Henry the Seventh, was wont to say, 'I am cast among courtiers, as salt among quick eels;' for he made them stir with his sharp and salt speeches. The powerful sprinkling, therefore, of this salt, will startle conscience, and make a sinner stir and look about him, peradventure, for a Saviour. But, as meat may be marred with too much or too little salt, so broken-hearted sinners may become desperate by unreasonable application of the law; and licentious men may grow more dissolute, by unseasonable setting forth of the free grace of God in Christ, therefore we must scatter wisely this salt."

But I must briefly notice some very interesting facts connected with the use of salt as a medicinal agent, as well as a manure for land, &c. Mr. Curwen, late member for Cumberland, and Lord Somerville, first drew the attention of English farmers to this most important condiment for sheep and cattle. The former gentleman was in the habit of employing salt, laid upon slates, for the sheep to lick up; he mixed it also with steamed potatoes and chopped hay for his horses and cattle. They invariably had smooth coats, and became very fat. No cattle surpassed his in beauty, health, and fatness. He found that they fattened rapidly in marshes; and when his beasts were sick, he always sent them thither, as to a medicinal agent. Kelp, by its saline property, when ploughed into his land, rendered the production of it double or treble in quantity.

His lordship observes:—"There are three points of view in which salt becomes an object of importance to the landed interest: as a manure worked into, and incorporated with the soil; as a top dressing to green corn crops in the spring season, like soot, malt dust, pigeon's dung, &c., or as a component part of the food of animals, more especially cattle and sheep."

Pilchards, on the coast of Cornwall, have been used as a manure, and with a success almost incredible. The success might be solely attributed to the salt, but we must not forget, the oil contained in these fish, when putrid, is equal almost to whale blubber, which is the strongest of manure. He continues—

"We had no doubt of the good effect of salt on mouldy hay; but it remained to be proved how good hay, which had not spent its strength in premature fermentation, would bear such a quantity of salt as would invigorate the stomach, quicken the circula-

tion of blood, and excite in cattle a desire to drink largely. Some medical men, aware of our practice, conjectured that salt tends to decompose and convert water to nourishment in an increased degree. Whether this is, or is not, to be so accounted for, we are incompetent to judge, but it is our business to know the effect which it has on stock; and we do know that it surpasses all belief. Some of our hay, lately in use, was of the first quality of sheep hay, the produce of a rich and deep loam, on a lime-stone bottom; it was put together without wet, and 25 lb. of salt per ton sprinkled through a sieve; a greater quantity than has yet been used. In colour, flavour, and proof, it equalled any hay whatever, and satisfies us, that this, or a greater quantity of salt, may be infused into hay of the best quality, and with the best possible effect. In confirmation of this fact, we have also the authority of Mr. Darke, of Bredon, one of the most celebrated graziers in the kingdom, who has mixed salt with his flooded mouldy hay, 8 lbs. of salt only to a ton, and declares that his Hereford oxen did better on it, than others on the best hay he had; and that he was convinced, that the hay had all its good effect from the salt."

In Spain, 1000 sheep consume, in five months, one quintal, or 128 lbs. of salt; and, on an average, their sheep fatten 13 lb. per quarter.

Lord Somerville did not find ten old sheep out of a flock of 1000, which refused the salt laid on the slates; on the contrary, they took it readily; and there was not one lamb which did not consume it greedily.

"When turnips, in the early season, are stocked with sheep, and the greens are rank and strong, many of the flock die suddenly, more especially young two-toothed sheep. The disorder is a pent-up wind, occasioned by excess of fermentation in the stomach; here salted hay and salt are devoured with a greediness that denotes their salutary effect. The autumn of 1801 was rainy and unfavourable, yet we did not lose one sheep in turnips, and probably never shall, whilst we persevere in the use of salt."

In strong pastures, likewise, when seasons are wet, the rot spreads destruction over whole tracts of country; here salt must be beneficial, and an object of national importance.

His Lordship gives us some most instructive and interesting cases of "Braxy" in sheep. It is a disease receiving the name of dysentery, but of a more fatal nature than that. The symp-

toms can seldom be observed, till all hopes of cure must be given up. Sheep have been seen eating heartily, as if in perfect health, and suddenly to start and fall down dead; and when opened immediately, the putridity of the whole carcase occasions a stench often so intolerable, as to force most people, however curious, to abstain from examination of the same.

The disease, in all its varieties, is inflammatory; and, from the great tendency of the inflammation to run into mortification, it may be termed a putrid disorder.

The progress of the inflammation, in general, excites great pain, but when mortification begins, the pain ceases; and then we may account for sheep appearing well, and suddenly dying. The causes of this inflammation may be various. Costiveness, from eating hard dry food, drinking cold water when the animal is overheated, or its being plunged into cold water while in that state, or suddenly drenched by rain, or chilled by a shower of snow; all, or any of these causes, may contribute to bring on this dangerous malady.

When a sheep is observed to be restless, lying down and rising up frequently, and at intervals standing with its head down, and its back raised; and when it appears to run with pain, inflammation of some of the viscera may be suspected. Bleeding ought immediately to be performed, and not sparingly; and an ounce of Glauber's salts dissolved in a quart of cold water, should be administered. On the second day, an enema of broth with a good deal of salt, should be thrown up, to clear the lower intestines, and as much nitre as will lie on a shilling dissolved in an English pint of cold water, and given in three doses, night, morning, and noon. Whatever food is given, whether it be cut grass, or turnips, &c. it should be sprinkled with salt.

I mention these important details, because the cases his lordship adds of recovery from the free use of common salt alone (or when salt could not be obtained, of Glauber's salts) throw a valuable pathological light upon the diseases of the human subject, which Dr. Stevens treated with salt. I presume the doctor was unacquainted with this valuable tract, otherwise he would see therein much to confirm his mind, and the mind of every unbiassed person, that incalculable benefits follow the free administration of salt in certain diseases of the blood. Dr. Harrison, of Jersey, observes, in a pamphlet on the rot in sheep, that this disease never appeared in the cattle feeding in the pastures of

that island; and he accounts for the fact, from the grass being saturated with saline matter from the sea water, which is carried by storms and high winds upon the face of the country.

I cannot refrain from copying one of the interesting cases of "braxy" adduced by Lord Somerville.

"In the month of Nov. 1802, a young sheep was brought home by the shepherd, affected with sickness. The wool was clapped; the eye languid, red, and watery. There was great heat over the body. The mouth was dry, the breathing quick and somewhat difficult. The pulse beat frequent and strong, and its limbs seemed scarcely able to support it.

"The tail was cut across in two places, when a considerable quantity of black thick blood flowed out. As no Glauber salts could be had, a handful of salt was given, dissolved in warm water, from a teapot: the animal was put into the house, and the door shut. In about half an hour it was laid down upon some straw, and appeared very weak. On approaching it, it rose, but could scarcely walk. The tail was still dropping blood. In two hours after it was standing, and ran to the other side of the house when it was approached. The eye was rather more lively; the tail had ceased bleeding, and it walked without any difficulty. In two hours more it was eating some hay that had been given to it, and the salt had purged it freely. It was kept in the house all night; and next morning, when let out to the park at the back of the house, it ate a little. The wool was still clapped, but the eye was lively, and the burning heat was gone off the skin. The purging continued all day. It was again put in the house at night. Next morning, when let out, it seemed quite well, ate very well during the day, and next day was sent to the flock. It had no relapse."

His lordship adds, that when this treatment was adopted at the first appearance of illness, three out of five lived, and did well. In those that died the flesh was of a livid hue. Black clots were found in the right side of the heart, and the food in the stomach might have been rubbed between the fingers like dry sand or chaff. There was also a redness observable in the brain. No mortification was seen in the bowels, but a general redness of the carcase.

CHAPTER III.

SALTS, ALKALIS, ACIDS, &c.

From the preceding facts it will be readily granted that the free exhibition of salts under certain conditions of the animal system proves salutary and most beneficial.

Some eminent chemists have ascertained that the blood of the human subject is less saline at one period than at another. In cases of fever, and inflammatory disorders, the salt of this fluid has been found diminished in quantity, even prior to the accession of the disease. So that the altered or deficient quantity of salt in the blood may be looked upon rather as a cause than as an effect of the disorder.

Fourcroy asserts, that fœtal blood contains no phosphoric salt, but a gluey or gelatinous substance in lieu of the matter called fibrine [1]. Yet subsequent writers affirm, that they have detected earthy salts as well as fibrine. During old age the blood undergoes very important alterations; its saline matter diminishes, and the supply of oil to it likewise decreases in quantity as well as in quality.

The presence of salt in the blood is proved by Dr. Stevens to be the main source of its change from venous to arterial in the process of respiration. This change is effected by the combined action of oxygen, salt, and oil. It may be laid down as a general rule, that whenever there is an excess of fibrine in the blood the salts become diminished in their relative proportions. Hence we find the salt of the blood in typhus, yellow fever, and rheumatism, &c., reduced one-half in quantity. On the other hand, there is scarcely any disease in which the salts of the blood are so much in excess as in gout. This superabundance of saline matter in the system, if not carried off by the skin and by the Kidneys, gives rise to those painful swellings and gouty concretions

[1] Annales de Chimie, t. vii.

around the smaller joints, which may remain for years upon the patient. It is not, therefore, surprising that a gouty individual should be in the habit of passing large quantities of gravel from the Kidneys, and this symptom is oftentimes a source of great relief to his gouty pains and swellings.

I might remark in this place, that the fluids, commonly known as the "joint oil," or synovial fluids, appear to me to be solutions of salt and oil. Whenever the relative proportions of these two constituent principles are altered, rheumatism or gout supervene. The former disease being, as I imagine, a preponderance of oil in the blood, whilst the latter exhibits an undue quantity of salt in the oil.

A diminution of salt in the blood not only occurs in the above-mentioned diseases, but it has been also noticed, in those distressing changes in the female constitution, as in chlorosis, &c., in a very clever pamphlet published by Mr. Jennings, of Leamington [1].

This gentleman observes, "that we may attribute some of the good effects produced in this disease, and similar ones, by a course of mineral waters, to the introduction of their saline matter into the blood."

There can be no doubt that those mineral springs which contain a small proportion of iron held in solution with some alkaline salts are at once the most salutary and invigorating to the constitution of delicate females. Hence the superiority of the mineral waters of Cheltenham, Leamington, Harrowgate, and Tonbridge, over those of other towns that contain no iron, and possess salts; such may be deemed rather adverse than otherwise to the deteriorated blood. For it will be found, that those springs, the salts of which approach in their chemical composition nearest to those of the healthy blood, are beneficial in those diseases that spring from a deficiency of saline matter in this life-giving fluid.

I have already referred to the interesting facts brought forward by Dr. Stevens, in proof that an undue exhibition of salt renders the system excited, feverish, and disordered. There cannot, however, be any doubt, but that a sufficient quantity of saline ingredients in the blood goes to perform a most important office in sustaining animal heat. Whenever, therefore, a deficiency of this salutary substance ensues, the individual is sensible of some general derangement of the constitution. There is a languor of body and mind; an indisposition to active employment or exer-

[1] Provincial Med. and Surg. Association, 1834.

cise; the circulation becomes feeble and sluggish; the extremities cold; the skin pale and chilled. This condition is the very opposite to that produced by an excess of salt in the blood. The body, labouring under such a train of symptoms as those just described, is very liable to an attack from any one of those diseases, ordinarily termed infectious complaints.

The connection that exists between the saline matter of the blood and its oil is a most intimate one; and any derangement as to the quantity or quality of the one will be invariably followed by some corresponding disorder of the other. We find almost constantly, that where we have every reason to suspect that there is a deficiency of salt in the blood, the secretions contain less of this matter than in health; and the bulk of saline matter seems, as it were, reserved and retained within the circulating mass. The urine of such individuals is almost colourless and clear; a certain proof that it contains but a scarcity of salt and oil[1].

The iron of the blood is likewise deficient whenever the natural quantity of its salts fails. Now this substance gets introduced into the circulation by means of the circulating oils; for I have already shown that oil contains a tolerably large proportion of iron. If this metal is conveyed into the system, either by means of mineral waters, or by medicines containing steel[2], the system rallies, and the pulse strengthens; the pale cheek becomes florid, and re-assumes the character of health and vigour. So, also, do the salts of the blood resume their wonted influence and power in the constitution; the individual becomes fat, and is again active and lively both in body and mind.

But this interesting inquiry might be carried out into a very wide field, and furnish matter for much practical information to the professional man, and, consequently, benefit to the sick. I am unable to pursue the subject in this work; nor do I consider it so intimately connected with the whole as to require anything more than a few remarks upon the properties and uses of salt in animals and in man. I shall, therefore, conclude this part of my subject, that I may offer a few observations upon the alkalis and acids of the animal economy, and their connection with the offices of the Kidney.

[1] Urea, technically called.

[2] Especially that excellent tonic, carbonate of iron.

CHAPTER IV.

SALTS, ALKALIS, ACIDS, &c.

In the conformation of all warm-blooded animals four elementary principles are invariably found, which enter into them as component parts; these are heat, water, earth, and air. From these four principles an animal is endowed by its Almighty Creator with life or vital action, whereby it is enabled, each one after its kind, to give out matter for peculiar animal substances, such as fat, blood, oil, bone, and muscle, &c. &c. The blood is entirely peculiar to animal life. Both fat and oil, in their kind, have their germ in vegetable seed, and are sustained in their growth; yet are they naturally and essentially different the one from the other. The fat in vegetable life is expressed or distilled from the blossom, or bud, or flower, and may be or not, in any degree, on the leaves or stem. But the oils and fat of animal bodies are to be seen and drawn from every part of the structure, internal and external, as the skin, the bones, the blood, the sinews, the vessels, the ducts, &c. &c.

"Dust thou art, and unto dust shalt thou return," was Adam's origin and curse. Hence we see, in the component parts of man, lime, earthy salts, alkaline salts, ferruginous admixtures with their various and intricate unions with animal substance of different kinds. But the most astounding feature in the character and composition of animal and vegetable fluids is this, that blood and oil, and sap and oil, are all alkaline in quality. There does not exist a vegetable substance that the chemist has hitherto analysed that has not for its basis an alkaline body or principle. It may be as well to remark here, that an alkali has a property the very opposite to an acid. These bodies can neutralize acids, and form salts; hence soda, which is a vegetable, and lime, which is an earthy alkali, can neutralize carbonic acid, and form a salt, known as carbonate of soda, or lime. Modern chemistry has done much in the way of extracting, and laying hold of, in a separate and

distinct form, this alkaline basis in many vegetables; and they find that the intrinsic properties of medicinal vegetables reside in this alkaline body. Thus we have the quinine of bark, the morphia of opium, the veratria of the meadow saffron and of white hellebore [1], all of them possessing a powerful alkaline property, and capable of uniting with acids, and so forming salts, as sulphate of quinine, acetate of morphia, &c.

But it is an interesting fact, that these vegetables not only afford an alkali, but that the bulk of them, at least all those which have hitherto been submitted to analysis, possess this body in their sap and juices. The plants from which potash is usually obtained are known to possess a large quantity of this alkali in their juices; and if the vegetable be steeped in water, or a decoction of any part of it, except its fruit, be made, and the liquor then shaken with pure magnesia, the potash will be readily detected and obtained. This, it is well known, is not the process employed for obtaining this alkali; it is ordinarily procured by icineration of the vegetable [2].

I believe, therefore, that it may be asserted, as a general principle, that the power and property of every medicinal plant resides in this alkaline agent, this vital quintessence of the plant. That man is the ablest chemist, who can, by dexterous and careful manipulation and analysis, so lay hold of this delicate agent as to present it in its purest and most natural form to the medical practitioner for the cure of human diseases.

There is an infinite wisdom in this curious and wonderful alkalescent property in vegetables; for besides the medicinal agency of this vegetable alkali, it is well known that alkalis and alkaline salts are the chief promoters of fertility; insomuch, that unless the earth is sufficiently saturated with them no vegetable will thrive in it, because these salts are absolutely necessary to the formation of a saponaceous and neutral menstruum, capable of dissolving the earth around the root of the plant; for earthy matter is incapable of solution by water alone; but this alkaline agent, which is found in the earth, also contributes largely to the solution of the earthy matter immediately around the roots, and thus the alkaline salt enters the pores of the roots, and builds up the solid part of the plant. Let us examine all substances in nature which promote fertility, and we shall find that they contain

[1] Colchicum autumnale. Veratrium album.
[2] Dr. Peschier. Ann. of Phil. tom. xii. p. 336.

an alkaline salt. Thus the excrement of animals, and of all putrefied vegetable matter, contains its peculiar salt. Lime is an alkaline agent, and possesses a peculiar penetrating quality, and is highly efficacious in fertilizing barren lands. Earth, by the continual action of the sun upon it during summer, is, in some degree, calcined, and furnished with a salt of the nature of lime. Hence the advantage of a summer's fallow, which is but the exposure of the naked earth to a hot sun. Hence, also, the fertility of meadows after inundation, for the waters having taken up and dissolved a large quantity of this alkaline agent, lime, deposit it upon the land they overflow. This is very remarkable in Egypt, where fertility depends, entirely, upon this alkaline earth or salt. The waters of the Nile, being gathered in the torrid mountains of Ethiopia, collect, in their passage, this salt, which it afterwards deposits on the Egyptian soil.

When any of these alkaline agents, as lime, or salt, or kelp, are laid on the earth, or exposed to the air, they attract the acidifying principle, oxygen, floating therein, till they are saturated, and become neutral. These being dissolved by rain, or dew, reduce the earth into particles fine enough to enter the pores of the roots of plants, where a part of the earth and salt is employed in the formation of the solids; meanwhile the juices, deprived of part of their earth, salt, and oil, become somewhat acid, that is to say, the acid is in some degree disengaged from the other component parts of the plant, and it has power to affect our organs of taste. But as the plant approaches to maturity, there is more absorption from the earth of its alkaline basis, and this mixes with the acid juices of the plant, neutralizes them, and the consequent change of the oil of the plant into a saccharine condition results. This process is greatly assisted by a hot sun, with occasional showers of rain; hence the delicious flavour of summer fruit after such changes in weather.

It is well known that vegetables imbibe the air, and this vital fluid is as necessary to them as it is to animals. The function of vegetable respiration is performed by the leaves of the plant, so that when the fruit approaches to ripeness, the leaves mostly decay and wither; and we may infer that when the acidifying principle of air is not required in the formation of the fruit, and that the juices are become neutralized, that then the leaves cease to respire, and fall off. When the juices are fully ripe, they are sweet, or, in other words, the acid is enveloped in oil, and a

portion of salt; for an acid thus modified seems necessary to the formation of a sweet taste, as we find to be the case with sugar, honey, &c. &c.

CHAPTER V.

SALTS, ALKALIS, ACIDS, &c.

The same alkaline agent which pervades the juices of all plants pervades, also, the vital fluids of all animals [1]. The blood of all the warm-blooded animals has a strong alkaline property; so, also, has the oil of animals. If the fresh blood of an animal be put into a retort, and a heat applied during much less time than is sufficient to make water boil, a vapour comes over, which condenses into a liquid, very little, if at all, differing from water, and which is neither alkaline, acid, saline, nor acrimonious. But if the heat is increased to the boiling point, the same vapour still continues to come over; and when it ceases to arise, the blood will have lost seven-eighths of its weight. If the heat be increased much higher, a yellow and fatty, or oily liquor comes over, slightly alkaline, and then the volatile animal salt, ammonia; and as the heat is continued, a black thick oil follows. When the mass which remains is exposed to a naked fire it flames, becomes white, and is then found to be an insipid earth, without the least trace of an alkaline property. Hence we find, by the destructive analysis of animal blood, that there exists in it water, oil, a volatile alkaline salt, and a fixed earth. If we attentively examine the process of animal putrefaction we shall find it produces the same results exactly as the distillation just described; and that it only differs from it in taking up a longer time for its accomplishment. For, first, the watery particles exhale; then

[1] I mean, by the expression "vital fluids," those that are essential to life, as sap in plants, and blood and oil in animals, in contradistinction to sweat and saliva, which are acid.

the saline matter ammonia, disengaged from the earthy substance, rises in combination with a part of the oil, and affects our organs of smell with a pungency and fœtor peculiar to animal substances. The remaining oil forms, with the earthy matter of the blood, a black, tenacious, and viscid substance, which is decomposed still further, until nothing but a pure earth remains: thus, from dust it springs, and unto its mother dust it returns. The animal fluids, from their alkaline property, have a strong tendency to putrefy. The carnivorous birds are sensible of this fact sooner than man; for when the process of animal decomposition begins, and the alkaline salts are exhaled, these birds are allured from considerable distances to the neighbourhood of houses inhabited by people with black fever, plague, &c. Thus our Lord observes, "Wheresoever the body is, thither will the eagles be gathered together;" and to his servant Job he said, "The eagle dwelleth and abideth on the rock, upon the crag of the rock, and the strong place; from thence she seeketh the prey, and her eyes behold afar off; her young ones also suck up blood, and where the slain are, there is she."

The fluids of those animals that feed on grass and other acescent vegetables, on ripe fruit and corn, &c., are less disposed to putrefaction than others, because they possess alkaline salts in a more moderate degree. So that they are not so fœtid and offensive as the former when putrescent; of these I may notice the lamb, sheep, calf, ox, the kid, &c.

Animal food is more or less alkalescent, according to the manner in which it is killed. Thus, if an animal is killed whilst very hot with long labour and exercise, as an ox after over-driving, the tendency to putrefaction in the meat is very powerful. Hence deer and hares, which are hunted, and birds killed by hawking, after a long flight, contract an immediate tenderness, which is the first stage of putrefaction; the barbarous practice of bull-baiting originated in this supposition, that unless the poor beast was worried and teazed for two days by baiting, its flesh would be so tough as to unfit it for sale; and there exists an old law, that bulls' meat should not be sold but with candles burning all around it, that the poor may not be imposed upon in buying it for meat of the ox.

The inhabitants of hot climates are obliged to use animal food very sparingly; and, through a neglect of this caution, northern Europeans, who travel far south, and indulge in much animal nourishment, become the subjects of dysentery, putrid fevers, &c.

Most of the insect, and of the fish tribes, are all highly alkalescent in quality. The fresh water fish are less so, however, than sea fish; and the softer sort of fish without scales, and the shell fish, are more alkaline in character than those furnished with scales. Hence the serious attacks of bowel complaint and indigestion which often follow a hearty meal of shell-fish. This is nothing else than an over-alkalescent state of the oils of the body, which so irritate the minute oil-ducts of the skin, that nettle-rash will often break out after the indulgence of shell-fish.

God commanded His ancient people, the Jews, to abstain from eating certain animals as food. The forbidden beasts are mostly extremely rank, and their fluids are very alkalescent.

But I proceed to notice a few practical results from the foregoing observations. The presence of an alkaline agent in oil and blood is essential to health and life; a redundancy of it is, however, injurious and prejudicial. The causes of an over-alkalescent tendency in the body may be considered to arise from, 1st, Food, that possesses much of this alkaline agent, as green vegetables, rich animal food [1], fish, and fowl that live on fish, carnivorous birds or animals, or those that are used to active exercise. 2d, A debility in the organs of digestion is another cause of derangement in the system; or, on the other hand, an excess in the quantity of blood and oil in the economy. Hence Hippocrates advises us to beware of an excess of health [2], and Celsus gives the like caution. 3rd, Long fasting, and a sedentary employment; excessive or long continued exercise; extreme heat of body, whether from season, climate, or from great exertion, produce also an alkaline excess within the body; the unnatural change of which is soon manifested by the following symptoms. Thirst [3]; an utter loss of appetite; an aversion for alkalescent and animal food, but especially for that kind of food that first caused the disorder; as we often find in persons surfeited with some kind of fish, or favoured food, or beverage. Fœtid eructations from the stomach, which leave a taste in the mouth like

[1] Milk must form an exception, however. Fish, which has been kept too long, and has therefore become rancid in its oil, and the rancid oil of a rotten egg, will produce diarrhœa, and derangement of the system.

[2] Lib. i. Aphor. 3.

[3] It is remarkable, that the internal use of alkaline salts excites thirst; yet in diseases of an acid nature, such as was, I believe, the malignant spotted fever, that is, an acidified state of blood, of 1836 and 1837, the alkaline salts quenched thirst, and the patients not only asked for them, but would seize hold of the medicine and drink from the bottle, in preference to toast and water, to slake their ardent thirst.

onions, or stale eggs, because a portion of rancid or putrefied oil is expelled with this flatulence: a bitter, and, oftentimes, most nauseous taste in the mouth, like rancid oil; this arises from a decomposed, and therefore disordered state of the animal oils; for, when these fluids are diseased, they become rancid, bitter, and fœtid, a fretting eruption about the mouth, lips, nose, &c.

In such a condition as this alkalescent state of the system produces, the patient should resort immediately to vegetable acids; as oranges, lemons, and other ripe acid fruits.

The effects of this derangement in the economy, are, to separate the particles, and alter the constituent principles of animal oil. The finest part of this oil, its elaine, becomes rancid; the other portion, the stearine, or suet, joining with the earth, or earthy salts, form obstructions in the vessels, and thus these salts no longer mixing uniformly with the water, oil, and remaining neutral salts of the blood, they become acrid, corrosive, and highly deleterious, if not soon expelled from the system by the secretions or drains of the body. The fluids which circulate in the vessels, whether they are destined for nutrition or otherwise, must be exactly suited to their peculiar and especial purposes just in the same way that each vessel is adapted, in its organization and vitality, to hold its respective fluid, "each one after its kind;" thus there must not be too much acridity in the bile, or in the salt, or in the saliva, or in the oil, or in the chyle; neither should acid superabound in the urine, or in the perspiration. If such a disturbance as that I have already pointed out, does arise in the system, we cannot be surprised to find all the fluids of the body altered in quality and quantity.

The corrosion and disturbance, which I here allude to, would take place in the same way, and from the same causes, if we were to place an acrid alkaline salt upon the external skin, and then confine it for a short time; it would surely irritate and abrade the part. In this state of the oil and blood, the fluids secreted, and drained from them, are fœtid, and much altered. The urine is high coloured; the mouth is parched with thirst; the skin is hot and feverish, and the whole frame greatly disordered.

CHAPTER VI.

SALTS, ALKALIS, ACIDS, &c.

All substances which affect the organs of taste with a pungent sourness, turn vegetable blues into green or red, and effervesce with alkalis, are termed acids. But I shall now confine myself to the consideration of the acids derived from vegetables, and those obtained from or formed in animal bodies. The subject does not admit of any notice being made of the properties of mineral acids, since my chief object is to show that the native acids of vegetables and animals are derived from an elementary combination of oil, oxygen, and nitrogen, in various proportions. I might pursue this consideration, and show that the oil of minerals forms a basis also to most of the mineral acids; but since I have omitted to notice the mineral oils, I can say but little of their acids.

It may be supposed, from what has been already advanced, that, since each plant in the vegetable kingdom universally possesses an alkaline agent as its base, the vegetable acids must, consequently, be very few. These acids are not found in the plant either as a permanent substance, at all times, and in all seasons, but they are met with in certain parts of the plant only, and at particular seasons. This part is the fruit, and the season is usually that of the summer and autumn. Thus we have the citric acid from the lemon and the orange; the nut of the gall affords the gallic acid; and the juice of apples, gooseberries, and other fruits, the malic acid, &c. These, together with four or six others, are the whole amount of native vegetable acids.

But a wise and gracious God and Creator has appointed one object to answer many ends. He has given unto man herb for the food of his cattle, and fruit for man's use, and eating. But each species of fruit contains within it the nucleus for a future plant, agreeably to Holy Scripture, "the herb yielding seed," as the grass and corn, "and the fruit tree yielding fruit after his kind,

whose seed is in itself," as is the case with the apple, plum, and prune trees, &c. He has placed the acid principle in the fruit, which is for man's food and enjoyment, but He has folded up in the leaf and fibre of the plant the alkaline principle. Now it is from these latter portions of the plant that the bulk of our medicinal agents are obtained, and thus do they fulfil the unerring word of God's truth, that "the FRUIT of the trees shall be for meat, and the LEAVES thereof for medicine;" that is, as the Hebrew expresses it more strongly, "for BRUISES AND FOR SORES," and "for the healing of the nations." (Ezek. xlvii. Rev. xxii.) O what a GOD of truth is our GOD!

There is a subtle, penetrating, and yet a most powerful acid, in the composition of all oils. But as this acid is so disguised, and wrapt up in the oil, by a large portion of alkali, or alkaline salts, the preponderating principle in oil is of an alkaline nature. Yet that there is an acid property in it, we may ascertain from the fact that the presence of this acid in oils makes the latter mix readily with alkalis, and form soaps. It is upon this account that oils preserve animal and vegetable substances from putrescence, when immersed in them. Mineral oils, if we may so term them, contain a manifest acid, as coal tar, or oil of coal, petroleum, asphaltum, naphtha, and other bituminous substances. In further proof that an acid enters into the composition of animal oil, it will keep for any length of time, when once deprived of its alkaline salts; as is the case with tallow[1]. This could not occur, if, like any other animal matter, it consisted merely of those principles peculiar to this its matter. For animal oils not only preserve themselves, but also all animal and vegetable substances with which they are combined; hence the art of potting various meats. There can be no doubt but that acids must be of great use in the bowels of the earth, because they are so universal; for, independent of their existence throughout inorganic matter, we meet with them in almost every mineral, mine, and rock of salt, as they are dispersed through every saline spring in every country. It is true, that they are always found in combination with a basis, for their very nature seems to be that they should seek

[1] The formation of soap, tallow, &c. does not consist in the mere union of animal oil with alkalis, but in the formation of stearic, oleic, and margaric acids. Oxygen in oil seems the essential agent in the production of these, and such like acids. Ann. de Chimie, t. xciv. p. 263.

Hence the researches of the French chemists upon animal oil, correspond with those of Sir H. Davy upon vegetable oil. Philos. Trans. 1808. Ann. de Chim. et de Phil. t. xxxii. p. 53.

union with a base in their mother earth, consequently they are not long without finding one, when first formed. But this prevalence of an acidifying principle in the earth, though it may be found under different forms, and in different degrees, nevertheless points out its importance, and the office that it is intended to perform, in the first instance, throughout inorganic matter. The acidifying principle in the air, oxygen, forms the active agent on animals, vegetables, and minerals. From the observations of those persons who are employed in the manufacture of saltpetre, and other salts, it would appear that the prevalence of oxygen in the air is greater with one wind than with another. When the nitre is laid out, the alkaline substance becomes acidified, or rather made neutral, sooner by a north and north-east wind than by those winds that are less bleak.

Many anatomical preparations may be preserved in weak acids, which will prevent their decomposition. The acids of vegetables are either native, or are produced in them by distillation and other chemical processes. Native vegetable acids appear to originate entirely in the juices which the plants draw from the earth, and not in the juices themselves, and hence they may be regarded as substances that the plant derives from the mineral kingdom; in proof of which we may instance those plants that grow in the sea, and have not their root inserted into any earthy or mineral substance, as the sea weed, which yields an alkaline salt, and an oily matter by distillation, but no acid. The sap of vegetables bearing fruit is acid in the spring of the year, not from any diminution of its alkaline principle, but from a redundant circulation of acid which the plant has drawn, by some vital action of its root, from the earth, for the purpose of nourishing and making ripe its fruit for man's use.

CHAPTER VII.

SALTS, ALKALIS, ACIDS, &c.

The immediate effect of vegetable or mineral acids upon animal matter is to char, blacken, and corrode the parts with which they

come in contact. Their influence on the blood is the primary cause of this effect. All acids blacken the blood, and the darkness of venous blood depends upon a redundancy of oil, which is highly charged with carbon and carbonic acid. This acid does not exist in venous blood as a separate principle, but it is wrapped up in its oil, and does not become at liberty to go free, until this black blood has arrived at the extreme ramifications of the pulmonary arteries, when the vital and chemical actions of inspiration and expiration, of decarbonization and of oxygenation, take place, and the excess of acid is sent forth as an extraneous, and, therefore, useless principle in the economy.

The acids which more immediately come under our consideration in the present treatise are those which are formed artificially, or by the decomposition of plants, or animal products, and are called vinous acids; thus the acid of honey, sugar, malt, and spirituous liquors, ale, porter, &c. These, and such like products exert, oftentimes, the most alarming influence over the constitution; and even if their effects are not soon evident, yet do they lay the foundation of serious diseases. The drunkard's fit of tremor and delirium, or of gout and gravel, though they are unequal in their rise and duration, yet are they both destroyers of life, if the habits which lead on to the diseases are not abandoned. These diseases originate in a preponderance of acid in the animal fluids, but more especially in the animal oil. This excess has been derived from the abuse of vinous acid contained in spirituous liquors, which acid exerts a powerful influence over animal oil, as I have related at some length in the preceding pages.

I shall proceed to notice some of the leading features of an acidified state of the system; and, first, I may mention, that the causes of this condition of the animal economy are, the habitual use of farinaceous food without a due supply of animal nourishment; the sudden change from an open country air to a confined, ill-ventilated apartment of a large metropolis. The charitable institutions in London have always a numerous class of female inmates, who have been sent up from the various counties to service in the metropolis, and whose habits of life are totally reversed in consequence. The diseases of which they soon become the subject are those arising from an acidified state of the constitution, as rheumatism, chlorosis, &c. &c.

The poor, who can scarcely obtain animal food three days out

of seven, who are confined in low, small, and unwholesome rooms, and who live chiefly on farinaceous food, would be much more subject to this disordered state of system if they were not habituated to active exercise, whereby the organs of digestion are strengthened, the circulation promoted, and the frame invigorated; so that an acrimonious excess in the blood is prevented. Sedentary individuals, and females in the higher walks of society, are frequently the subjects of this change of system. The food they take is so disproportioned to their strength, or of such a highly-seasoned and unnatural character, that although it may please the morbid palate, it, nevertheless, deranges the organs of digestion. There arise, in consequence, acid eructations after each meal, bitter and acrid taste on the tongue after a night of restless sleep, no real craving for wholesome nutritious food, but a sluggish and depraved appetite. Under these circumstances the acrimony of the fluids in the organs of digestion is communicated to the chyle, and to the whole mass of blood. This vital fluid, at the same time, is deprived of its saline and oily ingredients; its florid hue fades, and the patient becomes pale, haggard, and unhealthy in aspect. The serum, in such instances, is whitish, and the mass of blood thin, watery, and pale.

From this state of the vascular system, obstructions arise in the superficial and deep-seated veins of the extremities, especially of the legs, and the oil-ducts, falsely called lymphatics, which enter into these veins, become, in like manner, inflamed and obstructed in their course. There is oftentimes a troublesome itching of the skin, and pustules and ulcers over some parts of the body, which are pale, and slow in their progress towards healing. The occurrence, however, of these symptoms in weak, chlorotic, or cachectic persons, more especially of those afflicted with slight swellings of the legs and ankles, is so common, that it scarcely requires but a remark in this part of my subject.

There is a natural inclination in brutes, when sick, to seek out those substances which can relieve their disorders, and it is called instinct. There exists in man an intuitive perception of a source of relief to which he is, on many occasions, directed, and is relieved accordingly. It is on this account that females, labouring under an acidified state of the system, with acid eructations, and imperfect digestion in consequence, will eat lime and chalk, in order to prevent the acrimony in the stomach, under which they labour. It seems probable that under such a view Hippo-

crates was induced to lay it down as a rule, "that those meats and drinks, though not altogether so proper, which are agreeable to the patient, are to be preferred to those which are better, but unpleasant[1]."

Heart-burn, popularly so termed, is an unpleasant symptom in persons labouring under an acidified state of the animal fluids in the stomach and general system. It is to be relieved by a mild alkali an hour before meals, as a tea-spoonful of carbonate of soda in water with a little nutmeg. But it must not be forgotten, however, that there is a similar symptom arising from too much alkalescence in the system; but as this cause is a very rare one, I shall merely add, that a piece of bread, steeped in some lemon or orange juice, and taken before meals, will usually suffice for its entire removal.

In this acidified condition of the system the food should consist of those animals whose juices are more than ordinarily alkaline. Of these, I may mention the herbivorous brutes, as the sheep and ox, as well as those birds which prey on fish and insects, as the goose and the duck, but especially the wild duck, for Lemery says, that this bird possesses more alkaline salts than the tame animal, and is, therefore, higher in flavour; also the teal, and the widgeon, &c. The value of goose-grease, as a powerful liniment to sprained joints and to bruises, is well known, and its virtues reside in the abundance of alkaline salts of this animal oil, which renders it penetrating, and absorbs the excess of acids around the diseased and obstructed part. The partridge, pheasant, quail, and plover, are highly spoken of by Lemery, also, for their beneficial influence in acrid dispositions of the digestive organs. The wood-cock, snipe, and hare, and the eggs of the above mentioned birds, together with most kinds of fish, may also be numbered in the class of antacid foods.

The salts of those vegetables which yield pungent, alkaline salts, and possess an aromatic flavour, are equally beneficial in this state of system: I may allude here to horse-radish, mustard, &c. These salts in animal and vegetable substances neutralize and destroy the predominating acid condition of the organs of digestion, and of the animal fluids, and are the means of bringing the circulating system into that nicely balanced state which we know to be the source of health and of vigour.

[1] Hippoc., lib. ii. Aphor. 38.

In conclusion, I would beg leave to observe, that this disordered state of the animal economy is more common, more intractable, and more serious in its manifold results, than at the first glance we might be disposed to allow; that it leads on to very many distressing maladies, and is the slow, and, but too often, the fatal cause of the mass of mortal diseases which carry this poor corruptible body out of time into eternity. I have no doubt that time and experience, in the further carrying out of these views, will prove that delirium tremens springs from an acid state of the oil of the blood, which has been caused by the use and abuse of vinous acids in spirituous liquors; that cholera, in which frightful disease the whole mass of blood is black and thick, like pitch or treacle, and just as it becomes, if we pour weak acids upon healthy blood, is nothing else than a subtle deleterious acid pervading the oil of the blood; and I hesitate not to affirm, that this change may be as sudden, and as alarming, as the instantaneous death of an animal from Prussic acid, or from the Upas poison introduced into the mass of blood, or from the invisible malaria of country ague; or from the slower, but far more frightful process of the poisonous principle in hydrophobia. These are all acid agents, and destroy life, by depriving the blood of its inherent life-giving principle. They strike at the very vitals of man; and, as is the case with those who die from lightning, the blood never coagulates after death in any man or brute poisoned by the above agents; and the general results in all of them are very similar. I am, therefore, satisfied, that if a steady and persevering exhibition of alkaline salts is resorted to, in the above diseases, we shall find, just as the Indian finds, when he stuffs the wound he has received from a poisonous reptile, as the rattle-snake, &c., with salt, or nitre, that the deleterious influence of the poison is prevented; and the individual, or the brute, is rescued from a frightful and most certain death.

CHAPTER VIII.

DESULTORY REMARKS.

As many opinions have been advanced, and observations made, in the preceding pages of this work, which will, doubtless, create surprise in the mind of the non-professional reader, I think I should endeavour to direct his attention, in the succeeding pages of this chapter, to some of the most striking and remarkable features of the Kidney in its parts, as they have been made known by various modern authors in medicine, as well as by my own remarks thereon. We may as well begin at once with the consideration of some curious details upon the chemical analysis of human blood.

It has been already remarked, that oil forms one of the principal constituents of this vital fluid. Oil, however, enters more largely into the composition of blood than is generally allowed, or even suspected. But in order to form a tolerably correct judgment of the relative proportions of salt, oil, and glue, technically called fibrine, the following analysis of blood, which is offered by the eminent chemist Lecanu, the result of patient investigation and laborious research, is given. It will be remembered that albumen, as it exists in blood, is nothing else than a watery solution of oil, without any of that crystallizable base, which we find, for the most part, in animal fat. In short, it is the coagulating principle in the serum of blood, which Hunter recognized as a substance distinct from the watery particles in which it floated in the body. The comparative difference in the solid parts of the blood under fever, and in certain diseases of females [1], and in debilitated constitutions, will be also apparent on viewing the respective compartments of the table. The salts, as I have elsewhere remarked, are deficient; and the blood, being

[1] Analysed by Mr. Jennings, of Worcester, in his "Report on the Chemistry of the Blood," already referred to.

deprived of this necessary ingredient, as well as of its oil, becomes less red and rich in colour and in quality, and the individual is pale, sallow, and wan.

	Healthy Blood.	Healthy Serum.	Blood in Fever.	Blood in Chlorosis.
Water	785·590	906·00	856·	871·
Fibrine, or glue	3·565	....	2·	5·
Albumen	69·415	78·00	37·	60·
Fatty matter [1], crystalline	4·300	1·20	1·	1·7
Ditto, ditto [2], oily	2·270	1·00	2·	
Colouring matter	119·626	....	91·	48·7
Extractive matter, soluble in alcohol and water [3]	1·920	1·69	1·	3·
Albumen, combined with soda	2·010	2·10	2·	
ALKALINE SALTS.				
Muriate of soda, Muriate of potash, Carbonate of soda, Phosphate of soda, Sulphate of soda	8·370	8·10	3·8	7·6
EARTHY SALTS.				
Carbonate of lime, Carbonate of magnesia, Phosphate of lime, Phosphate of magnesia, Phosphate of iron	1·414	0·91	1·	1·8
Loss	1·520	1·00	3·2	1·2
	1000·000	1000·00	1000·0	1000·0

As the subject of the chemical composition of blood, and of animal fluids generally, is now so much in its infancy, and as the inquiries arising out of the diseased state of these fluids have been taken up but by a very few individuals, I can only throw out some hints, which may form materials, as they occur to my mind, for after-consideration. This indeed is the only apology I have to offer, for placing desultory remarks in a chapter apart from the subjects regularly connected with them, and treated of in the foregoing pages.

Mr. Jennings, in his valuable report, informs us, that "the alteration of the blood in persons afflicted with acute rheumatism

[1] I presume this substance is identical with the "stearine" of Chevreuil, found in animal fat.

[2] This is, doubtless, the "elaine" of the same chemist.

[3] A principle that Braconnet and Chevreuil found also in animal fat. It is sometimes called "animal matter" by other chemists, and it is allowed to consist of a compound of albumen and soda, though it has not received much attention from any of them, except Berzelius. I consider it an alkaline solution of the elaine or oily portion of animal fat.

does not so much depend upon the increase of its fibrinous, or, as I would term it, gluey proportions, but on some specific alterations in the nature of this fibrine, and which chemistry is unable at present to appreciate."

I have every reason to believe that subsequent researches will prove this disease to have its origin in an undue, and, therefore, unnatural prevalence of the crystallizable base of animal fat in the circulation of the blood. This solidifying principle is apt to be retained in the blood-vessels, and to become deposited around and within the various joints after a rheumatic attack, and hence the deficiency and alteration in the quantity and quality of the lubricating joint-oils, which arise when the patient is convalescing from the above disorder.

Mr. Jennings makes another very sensible remark on this point in his report, observing, "that dropsy is sometimes the result of a very watery condition of the blood, attended with a great diminution of its fibrine." This feature may be viewed as a symptom only of this form of dropsy; and we must carry our minds still higher for the source of the disease. That it springs from a watery state of blood is true; but does not the change originate in a sluggish and imperfect action of the Kidneys in draining the animal oil of its watery parts? and hence from passing into the blood in a state of watery oil, in lieu of a rich, pure, and unadulterated oil? But the same author proceeds to remark that "an entirely different state of the blood frequently exists in dropsy; for the disease, in some cases, appears to be occasioned by the greatly-increased quantity of the blood, its quality being in no way impaired." These two changes will form the distinction to be noticed shortly in dropsy, and which have been observed to differ in their symptoms by all writers, even from Aretæus to the authors of our day. The last-mentioned change consisting in a superabundance of oil in the blood thus it is common to robust, bony, and strong men, whilst the first form of dropsy is met with in debilitated and shattered constitutions, or in those who have long suffered from disease in some vital organ, as the heart, lungs, &c. &c.

To the concluding part of this chapter will be subjoined a few incontrovertible facts concerning the minute anatomy of the Kidney, which will give a succinct view of the general structure of the organ.

It has been seen in some of the foregoing pages of this work, that the peculiar secretion of the Kidney is therein maintained to consist of parts drained off from oil and venous blood. It is most interesting to observe how the Eternal Word of truth appears to join these two important matters together. Oil and blood, in type of Blood and Wine, are continually placed side by side. Thus the fat of the kidney of wheat is close upon the blood of grape. (Deut. xxxii.)

Above two thousand years before Jesus Christ's incarnation, Jacob prophesied thus of Him of the tribe of Judah—"binding His fole unto the vine, and His ass's colt unto the choice vine, He washed His garments in wine, and His CLOTHES in the BLOOD of the grape." Gen. xlix. The prophet, exactly two thousand years afterwards, thus speaks of the same Holy One: "Who is this that cometh from Edom with DYED GARMENTS, this that is glorious in His apparel, travelling in the greatness of His strength? Wherefore art Thou RED in Thine apparel, and Thy garments like him that treadeth in the wine fat?" Christ answers the inquiry of the Church thus: "I have trodden the wine press alone: and of the people there was none with me, &c., and their BLOOD shall be sprinkled upon MY GARMENTS, and I will stain all my raiment." Isaiah lxiii. Centuries afterwards the beloved Apostle thus reveals Christ triumphant over all His enemies: "And He was clothed in a VESTURE dipped in BLOOD; and His name is called, The Word of God." Rev. xix.

The good Samaritan, by whom our blessed Redeemer is meant, in His love, mercy, and compassion towards the destitute, miserable, and wounded, those who are wounded by their marauder, sin, from the crown of the head to the sole of the foot, represents Himself as pouring oil and wine into the wounds. Jesus gave the cup of wine to His apostles, and said, "This is my blood of the New Testament, &c., drink ye all of it." They could not drink blood, they drank the type of blood, the wine. So oil, being a type of grace, favour, and consecration, was used in the anointings of men and things, as has been observed: and it was also used, as a healing application, medicinally. These, then, are the two grand fluids of the Kidney; and of their refuse, the secretion being produced, it flows out with a daily, nightly, hourly constancy and regularity. As for the wheat, it was the emblem of the true bread which came down from heaven. That unction which the papists call a sacrament, which is used by

them in what they consider the extreme agonies, is the oil application spoken of by St. James in these words: "Is any sick among you? let him call for the elders of the Church; and let them pray over him, anointing him with oil in the name of the Lord." The custom which prevailed in St. James's time was to use oil as a healing remedy. The papists take this matter carnally, and treat the sick accordingly. But the ceremonial law, with all its types and shadows, passed away when the substance of the types and shadows came down to pour out His blood for man's ransom,—Immanuel, God with us, or in our nature. Baptism and the Lord's supper are the only sacraments our Church knows of. They are outward and visible signs of inward and spiritual grace, given and ordained by Christ as a pledge of favour and as a means of grace [1].

[1] So do we find, by our Lord's words, that oil is a type of grace, as we read in His parable of the ten virgins. They are called virgins, because they are not defiled with the corruptions that are in the world through lust. "Now these here," observes an old and quaint divine, "seem to be of that sort, for they are called virgins, both the foolish and the wise ones. The foolish take their lamps, that is, they make a profession of Christ. They had some kind of oil in their lamps, as appears from the eighth verse; they had some convictions and some faith, though not the faith of God's elect, to keep their profession alive—to keep the lamps burning. 'They went;' now their profession was not an idle profession, they did perform duties, frequent ordinances, and do many things commanded; they made a progress; 'they went.' Yea, 'They went forth;' they went, and outwent, they left many behind them; this speaks out their separation from the world. They went too with the wise virgins. They joined themselves to those who had joined themselves with the Lord, and were companions of them that were the companions of Christ. They go forth to meet the bridegroom. This speaks out their owning and seeking after Christ. When they heard the cry of the bridegroom coming, 'they arose and trimmed their lamps;' they profess Christ more highly, hoping to join with the bridegroom. They sought for true grace. Now, do not we say the desires of grace are grace? And so they are, if true and timely, if sound and seasonable. Why lo, here a desire of grace in these virgins; 'Give us of your oil.' It was a desire of true grace, but it was not a true desire of grace; it was not true, because not timely; unsound, as being unseasonable; it was too late. Their folly was not in taking oil, when they took their lamps; their time of seeking grace was when they came to Christ, it was too late to seek it when Christ came to them. They should have sought for that when they took up their profession; it was too late to seek it at the coming of the bridegroom; and therefore they were shut out; and, though they cry for entrance, 'Lord, Lord, open to us;' yet the Lord Christ tells them, 'I know you not.' Thus, you see, how far these virgins go in a profession of Jesus Christ, and how long they continue in it, even till the bridegroom came; they go to the very doors of heaven, and there, like the Sodomites, perish with their hands upon the very threshold of glory. They were almost Christians, and yet but almost; almost saved, and yet perish. You that are professors of the Gospel of Christ, stand and tremble; if they that have gone beyond us fall short of heaven, what shall become of such as fall short of them? If

We know that the fountain of the body is the blood, according to God's word. Speaking in a figure, the prophet says thus: "As a fountain casteth out her waters, so she casteth out her wickedness." (Jer. vi.) So Isaiah, "Thy silver is become dross, thy wine mixed with water;" but saith the Lord, "From the sole of the foot even unto the head, there is no soundness in thee, [professing Jerusalem] but wounds and bruises, and putrifying sores: they have not been closed, neither bound up, neither mollified with ointment, [margin, oil.] How is the faithful city become an harlot! it was full of judgment; righteousness lodged in it, but now murderers." But then, saith the Lord of life and mercy, "I will turn my hand upon thee, and purely purge away thy dross," [Hebrew in the margin, 'according to pureness,'] in the way of the working of sanctification.

To the casual reader, a person who has neither time, nor perhaps inclination to search diligently into God's word, labouring deep and hard for spiritual knowledge, as a man digs for gold or diamonds in a mine which has heretofore produced either of these costly articles; such comparisons, similitudes, and parallels, as these, drawn between natural and spiritual objects, may seem overstrained and farfetched. But as I am most certain that the Creator of all nature made every object in it to His own glory, and as the glory of God is Himself in Himself, so God ought to be, and is discerned, more or less, by the Christian, spiritually, figuratively, or rationally, in every created thing; whether by His ways, His mind, and "God is IN ONE MIND, who can turn Him!" says Job, or in His works. Had I the time, I could enlarge greatly on this subject, but thus much I can say: Happy is that man whose affections are so fixed heavenward, and whose eye is so directed to the altogether lovely, and chiefest among ten thousand, the man Christ, revealed to us as God in the light of God the Holy Ghost; whose heart is so disengaged in the midst of the cares, perplexities, and turmoils of domestic, professional, or mercantile life, that he can never cast a glance on bird, beast, flower, or reptile, much less study the organic structure of brute animal or man, without a bounding of heart

they that are virgins, that profess Christ, that have some faith in their profession, such as it is; that have some fruit in their faith, that outstrip others that seek Christ; that improve their profession, and suit themselves to their profession, nay, that seek GRACE, if such as these be but 'almost Christians,' Lord, what are we?"—From Mat. Meade's "Almost Christian, or the False Professor tried and cast." An. Dom. 1661.

towards His gracious Maker; a thirsting of soul after the righteousness of His God; and a hungering desire to taste more and more of the goodness of Him who takes the rebel to His throne, and the traitor to His breast; who having pardoned and redeemed him, and changed his nature, gave him holiness and Christ, without which such a habitation as heaven would be but hell under another name.

It has been already mentioned, on the authority of the celebrated Hunter, that the yolks of eggs receive their yellow tinge from the admixture of oil into their parts. We see in eggs all shades of yellow, from the very pale to the deep gold colour. The plumage of the canary-bird in their native country, the Canary Isles, is green; the plumage of the domesticated bird is yellow, from a dusky yellow-white to the rich gold colour of the deepest yolk of an egg. The silk-worm is in colour of a creamy yellowish tint; its produce is silk of every shade of canary yellow also, from the deepest colour of the yolk of an egg, to the palest tint of the canary shade. Would it not be a curious inquiry to bring these subjects side by side, and to attempt the ascertaining of the nature and quality of the oils which predominated in either?

Facts in the anatomy of the Kidney of man.

1. When the renal artery is injected, the terminal ampullæ, or pellets, (corpora malpighiana) are injected.

2. When the renal vein is injected these pellets are rarely filled.

3. When the artery is injected the urinary ducts are never injected.

4. When the vein is injected the urinary ducts may possibly become injected also.

5. The urinary ducts can be injected from the papillæ to the surface of the gland.

6. When the vein, artery, and urinary ducts are all injected with different colours, there yet remains a considerable mass of white matter not injected, and not injectible.

7. This non-injected and white matter consists of the innumerable white, semicircular, feathery, and lateral feathery oil-tubes, described in this work.

8. We cannot inject the reflected membrane.

9. We can inject the reticulated membrane.

10. There are no veins nor arteries in the papillary portions of the cones injectible.

11. There are many veins, and some arteries, in the tubular portion of the cones.

12. The papillary portion of the cones is wholly made up of oil tubes and urinary ducts.

13. The tubular portion of the cones is composed of lateral feathery oil tubes, urinary ducts, veins, and arteries.

14. The vascular portion of the cones is composed of lateral feathery oil tubes, urinary ducts, veins, and some arteries.

15. The vascular, or secreting portion of the gland, is composed of innumerable feathery oil-tubes, urinary-ducts, veins, arteries, lymphatics, and nerves, connected together by the reticulated membrane.

That the glands of the absorbent system perform an important, though hitherto undiscovered office with the fluids which pass through their chambers, there cannot, I think, be the least doubt. They appear to my mind as so many sieves. But that there is a distinct set of ducts in the animal body hitherto classed with the absorbents I have much reason to believe; as well as that this set pass through no glands, but act as waste pipes to the common sewer, the intestinal canal. All rivers run into the sea; any mud pool runs into the river. A gravel bed purifies a foul pond and stream. What the sponge is to the filtering cistern, or the gravel to the running water, so, probably, are the glands to the absorbents.

If the absorbents take up dead matter, and putrescent substances, as bone, muscle, &c., and carry them into the chyle-duct, and from thence into the blood, according to Hunter's views, it ought to follow, by consequence, that in a rapid consumption, or when matter has collected largely in the chest, and is becoming quickly absorbed, or when a large dead bone is in process of being removed, that, according to such notions, we ought to find the chyle reservoirs overflowing, without the article of food being in the question. The more suppuration and absorption within, so the more chyle! the more full the blood-vessels, the greater the mass of blood, and, consequently, the brisker the circulation! What absurd conclusions must we be brought to if such a doctrine

is to be received and adopted, and to be worked out into daily experience by the observation of diseases at the bed-side!

Facts in physiology and in medicine, in proof of two distinct sets of vessels, oil-ducts, erroneously termed lymphatics, and the true absorbents, that is, the lacteals, and other glandular absorbents, and the non-glandular absorbents, or waste pipes.

1. Inunction of mercury on the skin, especially if the surface be inflamed, produces dysentery, sloughing ulcerations of the large intestines, but not of the small ones[1].

2. Effused fluids, as in empyema, and peritonitis, &c., when removed by absorption, give rise to a diarrhœa, hence termed "a critical purging." I have often inspected the evacuated matters in such instances, and have invariably found the substances not fœcal matter, but a fluid resembling the white of an egg, or albuminous shreds, with some tinge of bile.

3. If there be inflammation of the absorbents, the larger veins do not become implicated in that inflammation, but there is a circumscribed abscess of the limb, and thus the inflammatory action resolves itself into a termination.

4. If there be inflammation of the lymphatics, or oil-ducts of a limb, the veins are sooner or later the seat of a similar inflammation; hence phlebitis, and obstructed circulation, œdematous feet, &c., in the ankles of weak cachectic females, and in old people.

5. In scarlet fever, a disease which consists in the admission of red blood into the absorbents, the whole intestinal canal is equally as red and vascular as the surface of the skin. As the one dies away so does the other fade.

6. Milk, urine, bile, &c. &c., when once secreted from oil, and sent into their appropriate ducts, are never "absorbed again by lymphatics, to be carried into the blood," as Cruikshanks asserts[2].

7. The fluid in the lymphatic or "oil"-glands, has globular particles in it, similar to those in milk. This fluid is found in the glands over all the body. It is greatest in quantity in young and growing animals, where more blood is required; but it is

[1] The waste pipe absorbents carry the matters to the bowel.

[2] Cruikshanks on the Absorbents, p. 43.

scarcely discoverable in old age [1]. This is oil, I believe, passing out of the several reservoirs of oil, through glands, to go into the blood.

8. Dr. Wm. Hunter, Messrs. Hunter, Hewson, and Cruikshanks assert, that all lymphatics pass through glands, but deny two sets of vessels, lymphatics and absorbents; hence the latter author is perplexed by and cannot explain the following fact.

"Mr. Hewson had an idea that there were lymphatics which entered the thoracic duct, without having passed through any gland; and that the duct might be injected from the great toe, without any gland being filled in the whole course of the vessels. I have injected the thoracic duct from the lymphatics on the back without injecting any gland. I confess that I have injected lymphatic vessels from the great toe, which ran along the lower extremity, and passed under Poupart's ligament, without having previously entered any gland [2]." These injected vessels were lymphatics, or oil-ducts, not entering glands. It is not necessary they should do so always, and we find it constantly occurring in the animal frame. But they do enter glands usually; the reverse is the exception to the rule.

The mesenteric glands, through which pass the lacteals and lymphatics, say Dr. W. Hunter and Cruikshanks, are obliterated in old age. "So that it may be possible that the chyle is prevented getting into the blood [3]." How can an old person live forty-eight hours, then, if such be a true statement? For in that space of time he will have expended 412 oz. of blood in the secretions of his body. His whole amount of blood is barely 400 oz. What, then, compensates for the deficiency if modern physiologists receive both of the above opinions? Here is chyle said to be prevented in its admission into the mass of blood on the one hand, whilst this vital fluid on the other hand is to secrete 200 oz. of various secretions in twenty-four hours, and life is to be continued in spite of such deprivations.

[1] Hewson on "The Lymphatics." [2] Cruikshanks, ibid. p. 79.
Cruikshanks, ibid.

PART VIII.

CHAPTER I.

COLLATERAL VIEWS OF THE KIDNEY.

Before I enter into the consideration of the diseases incidental to this wonderful gland, the Kidney, I shall offer some general observations, as they may arise in my mind, on the parallel types in the vegetable and animal kingdom, of this delicate and nicely-constructed organ.

By the Kidneys, it appears, that the emblem of life, or the seat of vitality, is intended by the Infinite Mind to be represented. When the Lord speaks of the quintessence of wheat, or its best, or most valuable part, its life, its vital principle, its quinine, as it were, then the Lord, the Spirit, expresses it by the kidneys of wheat, and the fat of the kidneys of wheat. (Deut. xxxii. Ps. cxlvii.)

Quinine is the expression I use to convey my meaning of vital principle, quintessence, &c. But man's way of extracting an essence, or vital part of a thing, and God's way, are two different things, and, consequently, must produce very different results. God, having put into objects of creation a vital principle, and bringing out that principle in His own mighty and magnificent way, produces one of two things; a feeding of the vitality in man or in animal life by means of the vital principle in an article of food, as, for instance, wheat, hence bread; or a reproduction of the species by the process of decomposition, in which the bulk of the body putrefies, or breaks away for the vital principle to expand itself into a new body of its own species and kind, as in a tree.

Hence the expression, "the Kidneys of wheat;" "fat of the Kidneys of wheat;" "Thou fool, that which thou sowest is not quickened except it die; and that which thou sowest, thou sowest

not that body that shall be, but bare grain, it may chance of wheat, or of some other grain: but GOD giveth it a body as it hath pleased Him, and to every seed (or principle of vitality) his own body."—" So also is the resurrection of the dead. It is sown in corruption; it is raised in incorruption," &c. (1 Cor. xv.) " Verily, verily, I say unto you, except a corn of wheat fall into the ground and die, it abideth alone: but if it die, it bringeth forth much fruit," said our Divine LORD. (John xii.) Now, what I mean to imply is, that an extract made by man from grain, as in spirit, or from bark, as in quinine, may be well in its way, and the vital principle may or may not be brought out fully and usefully. But what I chiefly maintain is, that the vital principle is so locked up in the casket of the body created for it to reside in, that mortal man can never so exquisitely handle the object as to say, my finger shall grasp it.

That very much indeed of the vital principle is locked up in the Kidney of brute and rational animals, I believe, simply, because I infer it from the Eternal Word of the GOD OF TRUTH and unerring Wisdom. Men are, alas! too often, so puffed up with earthly wisdom, that they need not the Divine Word for help to all wisdom, in the animal, vegetable, mineral, and spiritual kingdoms; consequently, leaning on the experience of man, and trusting to an arm of flesh as a prop, they draw their inferences after the manner of carnal men, and, in proud contempt of all beside, leave the mighty shadowings of GOD's almighty pencil in his tracery of the fabric of the human body, as beheld in His marvellous Scriptures, by the microscopic glass of illumined, spiritual intellect, to " Methodists, fanatics, and visionaries."

But what the infidel or the worldling rejects with carelessness or disdain, the humble, yet intellectual Christian, gathers up with grateful care, and with love, to Him whose bountiful hand giveth liberally, and upbraideth not. He, who searcheth all hearts, full well knows the motive with which the professional man or woman approaches the sacred depository of all truth, to glean from thence knowledge for his or her profession; GOD ALMIGHTY can tell the thought and desire of the mind; whether His glory be the object and aim, or whether the motive be a grovelling ambition for the poor praise of man, misnamed, too often, " the desire of alleviating the sufferings of our fellow-creatures." Far may it ever be, from the humble believer, whose soul thirsts after GOD, to approach any veil which GOD has thrown over a fabric of His own raising, or any part of that fabric, in

which it might appear that the ETERNAL MIND would see fit that man should never penetrate its mysteries.

With respect to the inward packages of brute bodies, there were directions expressly given in the Sacred Word, to select some, and to reject others. Much deep and wonderful information is given on the subject of the course of the solids and fluids in these packages: and if, in these days, the LORD would be pleased to give light, to gather up, and to concentrate, some of this information, bearing, as it all does, and is intended to do, throughout the blessed Bible, on the mighty work, redemption and atonement for sinful man, by GOD manifest in the flesh, I think that GOD would be magnified and glorified in every line of such a treatise; and that GOD the HOLY GHOST would acknowledge His own work in the soul, as in the intellect of the writer.

With a deep dependence on my heavenly and most gracious FATHER, for His condescending aid in this matter, I now proceed with the remarks I began to make in the preceding pages.

CHAPTER II.

COLLATERAL VIEWS OF THE KIDNEY.

I MUST again be allowed to repeat, that which is too clear to need repetition, that a wonderful GOD has bestowed on all creation's works individually, a vital principle of life. This, I think, He calls, "The seed." The seed, or vital principle, must have a house to live in, a bed to nestle in, a cradle to be brought up in;—hence its BODY. So, "GOD giveth it a body as it hath pleased Him, and to every seed his own body." Thus much, I think, is certain; and certain it must be, if I have caught the blessed meaning of the LORD, the SPIRIT.

If every body has its own seed, in which the vital principle is lodged, then the herb must have his, and the oak his, and the weed his, and the mineral his, and the brute his, and man his; each "in his kind."

Now in an object, consisting of many parts, there may be as

many inferior vital principles, if we may so speak—so far vital, as they affect the well-being of that part—for instance, the liver has its vital principle for separating bile, and not saliva; whilst the salivary glands have their vital principle, and the Kidney its vital principle for separating the drain, called urine. Let a stroke of lightning dry up an arm of a tree, its vital principle is gone so far, yet the tree lives. A cannon ball carries away a man's leg, or the palsy's stroke deadens part of his body, the grand functions of life may go forward; the master germ, or superior principle of vitality, being uninjured, he exists.

Now, "the blood is the life;" hence without blood, whether cold or hot blood, animal life cannot be sustained; that is, as far, of course, as regards animals in whom this fluid circulates. But man may lose quarts of blood and yet live, and regain robust health. He may lose half his original reservoir for blood, namely, both his legs and thighs in battle, or otherwise. He may lose three-fourths of his blood's laboratory, his lungs; but, I would ask, if any man could exist, much less enjoy, tolerable health and vigour, with his Kidneys destroyed, or so far diseased that they were comparatively useless in the economy?

But to return. "God giveth it a body as it hath pleased Him, and to every seed his own body," saith the LORD. So, "whosoever is born of GOD doth not commit sin, for his seed remaineth in him, and he cannot sin, because he is born of GOD." (1 John.) "Being born again, not of corruptible seed, but of incorruptible, by the word of GOD, which liveth and abideth for ever." (1 Pet. i.) "The kingdom of GOD is as a grain of mustard-seed," &c. So the wicked man, in his body, as Cain or Judas, has his seed of vitality, in common with the children of GOD. But, in the souls of the sons of Belial is NOT the seed, the incorruptible seed of GOD, nor ever can be. For this holy seed, when planted in the soul, abideth unto life everlasting. Thus, as it appears to me, a son of Belial may have convictions, fears, tremblings, light, illumination, great knowledge, precise notions, accurate creeds, yet, without the incorruptible seed, no vitality—no eternal life—no Christ—no salvation. For all his looks are upon the duties of his life, rather than upon the life of his duties.

The ALMIGHTY CREATOR of man has, in my mind, bestowed great honour on that inward part, the Kidney, in selecting it to be cut out of brutes, and offered up on His own holy altar with the kindred fat and caul, or midriff, as a typical sacrifice. Most important must that organ be in animal life, which is so PICKED

OUT BY THE DIVINE MAKER, who wound its every thread from His own finger, and spread out His own rich embroidery over every bone, with all its undulations, and convexities, of sinew, muscle, nerve, and vessel!

To my imagination, the Kidneys, or I shall say the Kidney, sits a sovereign in animal life, in the very centre of its kindred body. With one arm, as it were, she receives the oil, with the other she rejects its refuse. One power she attracts with, and with the other propels. Eight seconds after an article is taken by her from the mouth of the body, whether masticated by the teeth, or simply swallowed, or whether received into the body as an immaterial principle, as the effluvia of turpentine[1], violets, coffee, &c., it is lodged in its invisible quintessence in her bosom, and is from thence cast forth, according to the pure and sanctified language of Holy Writ, that "Whatsoever entereth in at the mouth, goeth into the belly, and is cast out into the draught," these defile not a man; but the pourings out of a corrupt heart are the things which defile a man.

The Kidney sits with her back against the reins, or loins, and hence she derives her strength; so in CHRIST all men have life, whether carnal or spiritual; "in Him we live, and move, and have our being." CHRIST is, indeed, the unknown GOD to some men, but to all is He the sustaining Power by whom all things consist, and of whom all things, in heaven or in earth, are. The nature of the Kidney is to be utterly incapable of generating the least atom of fat; yet is she embedded or enthroned in fat, and so is moistened, enriched, and kept supple. Thus, as she derives her stability and power of performing her functions from her position, leaning against the reins, or loins, so she derives her moisture, not so much from the multitude of oily channels within herself, as from the gracious and copious insinuating anointings of the fine unctuous matter all around and about her. Have we not here some shadowings of the natural man? He has not by nature one atom of grace, yet that oil of rich mercy is copiously shed, inasmuch as he is loaded with benefits, and is moreover invited to come to CHRIST the LORD for salvation; nevertheless, by his fondly loved sins, is he withheld, and so rejects eternal life. Much more is the Christian enriched by, and embedded in, the rich unction and oil of GOD's grace.

[1] Hay, turpentine, coffee, violets, &c., when presented to the nerves of smell, may be detected by their peculiar effluviæ in the urine in an incredibly short space of time, some seconds even.

This oil of grace, by the wonderful and secret operation of God the Holy Ghost, in the work of regeneration, is put by His Almighty hand into a fleshly tabernacle, a weak and carnal vessel, that the excellency and the power may be of God, and not of man. In like manner, the Kidney receives her oil and rich unction into a fleshy body, a space that is surrounded with corruptible flesh. Without this oil she would be fit for nothing in the economy; she would soon decay and wither, and then must follow disease, confusion, and death.

This wonderful gland has seven main oil tubes, to convey this life-giving fluid into the bosom of the organ; of these, the central tube is the largest. I recognise in this marvellous conformation, a striking similitude to the golden candlestick that was to be always lighted in the temple at Jerusalem. (Exod. xxv.) The type of the new man in Christ, or the light in the lantern and lamp, to the otherwise dark and benighted soul of the old man.

Again; the Christian can look up to Him, who is God in the eternal Father's nature, and man in His own nature, and with humble confidence exclaim, " I am crucified with Christ."—" They that are Christ's have crucified the flesh with the affections and lusts."—" The world is crucified unto me, and I unto the world; knowing this, that our old man is crucified with Him, that the body of sin might be destroyed, that henceforth we should not serve sin." The wonderful organs which an Infinite Mind commanded to be laid upon His altar, have a power of crucifying, destroying, rendering inert, and casting away the useless, unprofitable principles, which are engendered in the system, and are carried into their bosoms.

The world, the flesh, and the devil, are the tri-une enemies of the " new man;" doubtless, also, there are many enemies to the maintenance and progress of healthy structure, and organization, in the " old man," which the Kidneys have the power to eradicate and reject from the system. The old man must be crucified daily, as his antitype, these choice selections of the lamb, were sacrificed morning and evening. In this organ, set apart by the Creator for a daily sacrifice, type, and remembrance, of the sins of the old man, and his dependence on " the Man," the Christ of God, there was a shadow of good things to come, and not the very image of the things, for Christ Jesus is the brightness of the Father's glory, and the express image of His person; as it is written, " who is the image of the invisible God, the first-born from the dead." But in those sacrifices there is a remembrance

again made of sins every year, but now our Passover and our Sacrifice hath been once offered to bear the sins of many, and by that one offering hath for ever perfected them that are sanctified, so that there remains no more sacrifice for sin. Hence we have put away all these types and shadows, this blood-sprinkling and burning of offerings, because this MAN after He had offered one sacrifice for sins, for ever sat down at the right hand of GOD.

CHAPTER III.

COLLATERAL VIEWS OF THE KIDNEY.

As we view these wonderful types which GOD ordered to be selected for His own altar and sacrifices, we must be struck with that remarkable one,—the fat. "All the fat that is upon the inwards;" the richest, the best, and the most valuable of man's estate, whilst on earth, are thus to be dedicated and given up to the LORD His GOD. But, as these mercies and outward blessings, such as health, prosperity, domestic comfort, tender relations, &c. &c. must flow from a source, even from Him who is the Author and Giver of every good and of every perfect gift; so, also, must the rich anointing of man's animal frame, and the vital warmth of his life-giving blood and oil, have a fountain from which these principles may spring and flow out, a reservoir which pours them forth, a casket which contains these jewels; this spring-head is no other than the Kidney with its own anointing oil; hence I look upon these bodies as the most important in the animal frame; for without them, as without the seed-kernel, or Kidney, in the orange and lemon, or the kernel, or Kidney, in the grain of corn, or in the acorn, no reproduction of the species could take place, oil being the essential, or vital principle, in every seed, "after its kind;" for although there are organs especially set apart for the procreation of the species, yet they would be utterly useless in the economy of nature, if the Kidneys did not sit in their

health, strength, and vigour, as the master-springs in this wonderful process[1]. Hence the Hebrews, according to Calmet and Cruden, ascribe to the reins, or Kidneys, knowledge, joy, pain, or pleasure; and it is often said, in Holy Scripture, that "God searcheth the heart and the reins."—"I will bless the Lord," saith the Psalmist, "who hath given me counsel; my reins also instruct me in the night season."—"Thou art near in their mouths, and far from their reins;" that is, Thou art far from their hearts and affections; they have neither fear of Thee, nor love for Thee, nor desire after Thee, nor delight in Thee, nor are they obedient unto Thee[2].

But when we go higher than this, and view these curious bodies in a spiritual light, and, by the help of God's Holy Word, we see them in their organization distinctly shadowing out three most important features in the economy of man's redemption and salvation.

1st, The blood, which was to be poured out beside the altar of pardon, whereon these bodies were about to be burnt as sacrifices. 2nd, the oil sprinkled, or the fat of sanctification, with pardon by substitution and by blood, and by Divine unction; and, 3rd, the whole as of grace and favour, as shown typically by salt. So blood, oil, and salt enter into the composition of the type, the Kidney, and pardon, sanctification, and grace, are bound up in the one and final Sacrifice, the great antetype, Christ, the Lord, and our Passover.

From the observations that I have made, the results which strike most forcibly upon my mind in the consideration of the shadow and type which God has folded up in the Kidney, may be summed up in few words. It is a compound body, consisting of two most essential parts, its flesh and its oil; the former encloses the latter, and surrounds it just as the skin covers the body. The oil is its life: the flesh is subservient to this oil,

[1] The vital principle of life, and the vital power of reproduction of the species, is NOT ONE and the same. The one principle is ever in action in a living body, the other may never be exercised. Thus there are some animals that never have young at all. The mule bird, and the mule quadruped, have a principle of life, but no principle of reproduction. Have these animals Kidneys, in as perfect a state of developement, and with as much supply of oil, as other animals? Mules are not a pleasing production to God. He forbids their unnatural production, and will let the monstrous species extend no further. "Thou shalt not let thy cattle gender with a diverse kind: thou shalt not sow thy field with mingled seed: neither shall a garment mingled of linen and woollen come upon thee." (Levit. xix.)

[2] Cruden's. Also, "Thy Son which shall come forth out of thy loins." (2 Chron. vi.)

for upon it depends the vitality and health of the blood, and, consequently, of the flesh.

The corruptible flesh, when removed from its natural atmosphere, the living body, must soon decay; the oil, with its apparatus, does not follow the same laws. Oil and tallow may be preserved for centuries; not so with dead flesh. Here is a perishable body, and an immortal soul shadowed out in this organ; here, also, is the old man and the new man folded up in this mysterious type. The organ being two-fold in composition, is, necessarily, duplex in its actions, in its structure, in its properties, in its tissues, and in its qualities. For it purifies blood by draining blood, and yet it nourishes blood by anointing blood with a supply of oil. It purifies oil by draining oil, and thereby preserves oil from decomposition. Hence we may say, it purifies oil and blood, whilst it nourishes and preserves both of these life-giving fluids. It has an external and perishable coat of flesh, whilst it has an internal and non-perishable nucleus, or matrix. It has urinary ducts, and it has oil-tubes. There is an external, and there is also an internal membrane. It is nourished by blood, and it nourishes blood. There is a set of reticulated blood-vessels, a set of feathery oil-tubes, a smooth and external membrane, and a reticulated or internal membrane. Can we affirm these principles of the structure of any other part of an animal body? I can answer, that I know of none.

What the mouth of man then is, to the body of man generally, so is the mouth of the Kidney, to the blood in its support of life. But, above all, is the mouth of the immortal soul, faith, by which she receives the food of life, and having, by rich mercy and Divine unction, fed on spiritual good things, Divine bread, Divine wine, feasts of fat things in Christ, holy, rich, and ever new, her whole frame is invigorated, cheered, and refreshed; she leans on her Beloved, and looks up unto her Heavenly Father in her God.

But man's body is the vehicle for all attainments. This is the grand honour which is put upon it. It is a cradle for the new man to be rocked in, out of infancy into manhood, out of time into eternity. The eye of man runs along the page of Revelation, and carries up to the mind stores of knowledge, of wonders, of mysterious providences unravelled; the mind beckons up Faith to come and open her arms to catch up all that may constitute a feast for the soul. Faith receives from the mind what the mind received from the senses, and, hastening to the new man,

she spreads before him what he gladly feeds on in its spirituality and truth. Thus is the soul fattened, and fed, and sustained in CHRIST JESUS, her LORD, and her GOD.

CHAPTER IV.

COLLATERAL VIEWS OF THE KIDNEY.

WE may talk in our day of worldly wisdom, of the wonderful structure of the steam-engine, the most complicated contrivance of man's proud art, but what is that compared to the most wonderful complication of movements going on in the human frame! Here is the mind with all her attendants; brain, nerves, ganglions; with her smelling, and hearing, and tasting organs in full play, a very world in herself. There sits, in all her wonderous structure, the mouth, with her numerous train of important servitors, teeth, tongue, palate, with its tasting, feeling, and muscular nerves, saliva, gullet, and windpipe, a very world therein.

Then rises the chest, with the wonders of palpitation and circulation; and the lungs, with her innumerable cells to chase the globules of air and blood through the endless sinuosities; and then the stomach, wondrous organ! busy with her digestions and chylifications, &c. But, above all, the Kidneys, the emblem of man; there they are, as selected by the wonderful finger which packed up so much within and without, and varnished it over with a polished skin, and called the whole structure man, to be offered up in type to His own magnificent honour and glory. Here and there run the fluids of various consistences in their vessels; and there are the solids, some stationary, some to be thrown away as done with: in, and about the whole, runs the fat, of all consistence, from almost a thin oil to marrow, brain, or suet. It is, indeed, a mysterious world to look into; a world above, and within a world; but, above all, a kingdom within worlds. "The kingdom of GOD is within you;" or, alas! within you is "the kingdom of darkness." The mind, unaccustomed to such re-

search, is speedily overcome, and can only vent itself in words of Scripture: "Behold, I am fearfully and wonderfully made! Marvellous are Thy works, O God, and that my soul knoweth right well."

Of all the conductors, vessels, and tubes in the human frame, perhaps none are so wonderful, exquisite, versatile in power, and submissive to various uses, as the NERVES. Beautiful as are the splendid discoveries of Sir Charles Bell, yet, to my mind, not half has been said that might have been said upon them. They stand before my mind's eye as exquisite, elongated sponges, fitted to take up sound, as in the nerves of the ear; sight, as in the optic; smell, as in the nose; and taste, as in the nerves of the tongue and palate; and to take up the touch or sensation of a body, as in the delicate sensibility of the nerves under the whole skin. But the mere taking up of the particles, essences, or corruscations, as in smell, or sound, or sight, is but little in comparison to the absorption of vitalities for the sustaining of life in the animal economy. Equally wonderful is the rapid communication between the mouth of the outer body, as it were, and the mouth of the inner body, the Kidney. How is it that effluvia, sucked in at the mouth by the breath, is, in eight seconds, lodged in the centre of the Kidney, if it be not by rapid suction of the pores of the nerves running up to the mouth of the inward vitals.

If one end of a common sponge be in contact with water, how soon does the other end become wet, though it never touched the water. Does not a fluid then travel up and down a common sponge? How much sooner may not a vital essence, charged at one end of a nerve, run along it, and deposit its principle on the lap of the Kidney. The Kidney does not start forward or upward to catch the noxious effluvia, that it may be expelled from the system as quickly as it was admitted, but the spongy nerves may absorb this principle to carry it down to the Kidney. Much more, methinks, shall sound knock up against the nerves, and entering their pores, fill them, and lodge their contents in the brain. For conductors must have a conduit, as a fountain has a bason, and a river has a sea to flow into. So the nerves find at each extremity a reservoir; a brain, and a Kidney. The blood vessels have a heart, the bones have their knobs or joints, and the chyle tubes have their grand duct[1], &c. The objects of the

[1] Anatomically termed thoracic duct.

senses seem to be as inlets or doors, to let in certain vitalities, essences, corruscations, or invisibilities, for the nerves to absorb, and carry to their respective grand deposits, as above-described, exciting their respective feelings, emotions, or workings.

But to conclude, the spongy texture, or tubular character of nerves, has been most ably proved by the microscopic examination of nerves, and by the researches of some of the continental physiologists, as well as by our own countrymen; and, what renders the subject of far greater interest is this, that the tubular organization of these conduits of the human body is different in nerves having different offices; as the nerve of sight, and the nerve of the stomach.

CHAPTER V.

COLLATERAL VIEWS OF THE KIDNEY.

In all mere human theories, the Christian, or believing sinner, whose eyes God has vouchsafed to enlighten through undeserved mercy, has but too great reason to mourn, as he reads the speculative fancies of that once noble seat of intelligence, the mind; once noble, and capable of high attainments, but, alas! by sin defaced, confused, and disfigured; shorn of her beams, restricted in her powers, restrained in her exercises, enervated in her energies, debased in her propensities, broken in her calculations, unsettled in her conclusions, faded in her beauty; a wreck, a remnant, a fragment of moral excellence, and immaterial greatness. Such, alas! the Christian finds the theories of mere human intelligence to be; he well knows that his own theories rose no higher than those of his fellow-men, and that, on many occasions, in which he had to put forth the powers of his own mind, that he sank below many of his contemporaries; but this he also must be sensible of, that when God enlightens that mind of his, to see the beauty of Almighty, as gloriously displayed in the majestic offices of the Holy Trinity, the love and grandeur of the

Eternal Father, the work and loveliness of the Eternal Son, and the light and power of the Eternal Spirit, his own narrowed and enervated understanding became expanded; his capabilities of mental exertion increased; and that, with the expanse and increase of light and power, arose a general fixedness of purpose to search more and more after God, as the beginning and end of all wisdom, the Alpha and the Omega of all good, and by consequence an elevated standard was thus raised as an object to work up to, and a foundation, broad as the heavens, deep as the earth, even the Rock of Ages, was established in his soul, to work from and upon, as a sure, and certain, and immovable base. Hence holy David, the shepherd boy, when elevated to the throne, bore this testimony, "I have more understanding than all my teachers." For why, O David? "For thy testimonies are my meditation."—"I understand more than the ancients, because I keep Thy precepts."—"Through Thy precepts I get understanding, therefore I hate every false way; morally false, and physically false." (Ps. cxix.) "The entrance of Thy Word giveth light; it giveth understanding unto the simple;" even unto the ignorant. But, more than this, "The fear of the Lord;" just apprehensions of God in Christ by the Spirit, "is the beginning of wisdom." What wisdom? Heavenly wisdom, temporal wisdom; yea, all wisdom, "and the knowledge of the holy is understanding." (Prov. iv.)

This is the wisdom acknowledged by God. All other, standing apart from a heavenly foundation, is but foolishness with God, as is expressed in the Scripture, "The wisdom of this world is foolishness with God."—"For that which is highly esteemed among men, is an abomination in the sight of God," saith our blessed Redeemer.

But it may be said, how can heavenly wisdom be wanted to discern that which is incontrovertible? or to distinguish that which is obvious? Does an astronomer require the light of religion to tell one star from another, or does the butcher require the light of revelation to distinguish beef from mutton?

We reply, that amidst the wreck and ruins of the fall, God has still vouchsafed to man a marvellous intelligence, wonderful faculties, and supreme distinction over the brute creation. By the mere force of reason, man has attained to much knowledge, such as it is; by the force of intellect, highly cultivated, and constantly exercised, man has risen to eminence, such as it is, among his fellow-men. By the force also of intellect, on which

the light of revelation has shone, man has gone higher still; his attainments have risen surprisingly high, to such as they are; but, granting all, and making every allowance, the Christian man, though a tinker, shall discuss a subject, nay offer his surmises upon a subject, with greater accuracy, more soundness, fuller precision, than the highest philosopher of the day, if not a man "created anew in Christ Jesus," shall ever attain unto, with all the light which God may be pleased to grant him in the way of ordinary endowment.

These remarks may appear ill-grounded; but however that be, I desire to make them, because there is truth bound up in the whole bundle of them; nevertheless, I do not expect to be accredited by the world, because God the Holy Ghost declares, that "The natural man receiveth not the things of God, neither can he know them, for they are foolishness unto him, because they are spiritually discerned." (2 Cor. i.)

These observations lead me to the subject I proposed to discuss in the two preceding chapters, namely, the consideration of the wheel within wheel, by which the functions of the human body are progressively carried forward; and here I desire to leave mere human reason and calculation, and cling again and again to the sure, solid, eternal word of the living God.

CHAPTER VI.

COLLATERAL VIEWS OF THE KIDNEY.

In the majestic account of the vast work of creation in the first pages of Genesis, we find this remarkable explanation,—short, wonderful, divine,—"whose seed is in itself."

Here then is the riddle expounded, the mystery so far cleared up. The Eternal God fabricated the whole machine. He places over its great and little wheels, His own sustaining power. He issues the command, Be perfect each in your way, your kind,

your degree, and in your region; do your work, go forward; fulfil your appointment in your appointed day, each one of you in your place. Let every organ in man be as a seed which is in itself for his own peculiar and particular purposes, all of you subservient to the maintenance of the human fabric; the whole fabric Mine, and absolutely dependent on My unerring will.

So the God who said, "Let there be light," and light there was; who by the Eternal Word, the Son, "measured the waters in the hollow of His hand, and meted out heaven with the span, and comprehended the dust of the earth in a measure, and weighed the mountains in scales, and the hills in a balance;" Who gave a mighty moving power to those waters, so measured in the hollow of His Almighty hand, that they should never be at rest, and yet, in order that they might not overspread their boundaries, set "bars and doors," with the command, "Hitherto shalt thou come, but no further; and here shall thy proud waves be stayed." (Job xxxviii.)

This same Lord bids the functions of animal life go on, and to each organ of the animal frame says, Thus far is thy work, and no farther; and over the whole reigns this God supreme, agreeably to the wonderful words of God the Holy Ghost, by His servant Daniel, "The God in whose hands thy breath is," and, consequently, more easy were it for Him to expunge that breath from the body, than for us to raise the extinguisher and drop it over the flame of a waxen taper.

Hence the secret of the beauty, and order, and regularity of the working of the wheels, the great and little wheels, the complicated machinery of animal life. Divine power winds up the machine day by day, and bids it go on. The God of all nature cannot be disobeyed: as when God incarnate said to the water, Be wine! and the richest wine instantly took the seat of the limpid and colourless water; so when the same voice is heard by attentive nature, she puts forth her energies to obey, and behold! the exact proportion of wholesome food being lodged within the frame, and appearing presently in the form of white and nutritious chyle, is anon the rich, red, generous blood, which is the flood life travels in, up and down, and down and upward, through the animal economy. But let the mighty God of all power and order pronounce the word, Halt! and a dead stop shall be made to every progression; the wheels shall be motionless, the fluid of life congealed, the breath suspended, and silent and sure will be the work of decomposition and decay.

But, on the other hand, let the same Eternal Word be uttered, peradventure thus: "Thou little wheel be clogged in that man; he requires chastisement, or My judgments, for his iniquity;" then indeed shall it be said, "LORD, how soon is the fig-tree withered away," for, "when Thou with rebukes dost correct man for iniquity, Thou makest his beauty to consume away like a moth." (Ps. xxxix.)

So then, under the supreme influence, not of the command for the absolute annihilation of the soul, (for the soul cannot cease to be,) for "every one of us shall give account of himself to GOD," (Rom. xiv.) but of the derangement of the flesh, in disorders of the human frame, we find, that the simple disturbance of one ministering agent, one vital organ, is sufficient to produce discord and confusion among the whole; and hence the parching fever, the benumbing palsy, the bewildering delirium, the burning inflammation, the hydra-headed hypochondrium, the inflating dropsy, the depressing jaundice, and the attenuating cough. One little clog, on one little wheel of the machine, produces all the consequent derangement; nor can all the powers of earth, of men, nay, of angels, much less of eminent physicians and surgeons, effect one jot or tittle of amendment, until the same LORD, who commanded the disorder, shall, in His Divine wisdom, recall the command, and give the word for health, and restoration to order. So that in this view, though it be lawful, nay, our bounden duty, to make USE OF ALL MEANS, and to call in the physician and the surgeon's skill, and, if need so require it, to take the potion of the one, or to submit to the lancet of the other; yet are we also to feel, as our blessed REDEEMER said, "WITHOUT ME, YE CAN DO NOTHING." So that with Him, even a poison may be a balsam; and even a balsam may be a poison.

To conclude these observations: I believe that the GOD who formed man in all his intricate comeliness of parts, and beauty of structure, and who also ordained the types and shadows of mighty things to come, by a daily offering of one particular part of the brute, knew full well how far that part was subservient to animal life. Not the lungs, not the heart, or the head, were commanded to be laid on the sacrificial altar, but the Kidneys, caul, and fat, as a type of the natural man; as the work and workings of nature, are a type of the workings of grace in the regenerate man in CHRIST JESUS the LORD.

PART IX.

CHAPTER I.

ADVICE, &c. ON HEALTHY URINE.

I SHALL now endeavour to take up the subject of man, not as regards his original state of innocence, for of this, alas! we have little conception, by reason of our vile departure therefrom; but of his state as a fallen creature, yet with the ruins about him of his creation, "in the image of GOD."

Herein we view him as the noblest of GOD's works, and a pattern, more or less, for all animated creation, in his heart, blood, vital organs, nerves, vessels, senses, &c. He is the pivot, as it were, around, and from which, the infinite mind of GOD has made to diverge all the creative rays of organized beings, or bodies, in the animal, vegetable, and mineral world.

But his mighty pre-eminence, even amid the ruins of the fall, consists in his possession of a rational mind and soul; his immortality is attached to his being, "Thou shalt never cease to be," is written on his expanded forehead, on his intellectual eye, on his erect demeanour, on the wonders of utterance in the volubility of his tongue, and on his marvellous faculties. He is formed for eternity; although his present body, as a grain of corn, has written on its susceptible organs "for time!" but, as a grain of wheat when buried in the earth, is hidden but to rise up again in a new form, so the human frame, in its generation, sinks under disease, and is buried, but to rise in a lovely or unlovely shape, to be buried no more for ever; but to be re-united to the immortal soul, which, on parting from its mate in a state of misery or of bliss, awaited the indissoluble adjunction as the grand work of a judgment-day.

As, then, our consideration is with man in his fallen estate, we are to view him also in his state of bodily ailments. In reflecting

on him thus, we naturally glance at his ailments of the soul. The first of which we are all the subjects of. To the last we are all liable; for, as the seeds of every disease are in the body of every mortal man, so are the seeds of every sin in the soul of every human being; and, as climate, diet, occupation, habit, or the being under the influence of peculiar passions, foster the seeds of this or that disease, and bring it prominently forth to strength and maturity, and so hasten on dissolution of the body; so do the actions, the influence of temptations, of opportunity, of example under the working of peculiar passions, nurture the seeds of this or that sin, and bring it forth, in all its vigour and malignity, in its degree of slow or quick, to its full growth, as with its reward annexed. "The wages of sin is death." So God the Holy Ghost declares: "Let no man say when he is tempted, I am tempted of God; for God cannot be tempted with evil, neither tempteth He any man: but every man is tempted when he is drawn away of his own lust and enticed. Then when lust hath conceived, it bringeth forth sin; and sin, when it is finished, bringeth forth death." And thus, as every human body is the seat for disease, and is a calyx for every seed of suffering, so also is the soul the medium for every conceivable sin, as utterly corrupt nature, throws up the mire and filth of every species of iniquity, from that unfathomable abyss of wickedness, the heart of the old Adam in man. Even so, therefore, as the Eternal God in Christ declares, that no man can serve two masters, neither can two master diseases reign in the body, any more than two master sins are seen to govern the soul: "the sin that most easily besets you," says the Apostle. Every man having in him the master sin, the little leaven which leavens the whole lump of his universally corrupt and iniquitous nature.

Thus the body is subject to the influence of disease, but one only masters it at a time. The soul, in like manner, is subject to all sins; but one only is the dominant sin or passion.

So in the new man, created in Christ Jesus, one master spring governs it, and this is the grace of faith, the most undeserved, munificent gift of God in Christ Jesus His Son, in the power of the Holy Ghost. "For by grace are ye saved, through faith, and that not of yourselves, it is the gift of God." —"The just shall live by faith."—"By faith ye stand."

The senses are the inlets to the passions. The passions are the master springs of the old man, as grace is the master spring

of the new. The besetting sin reigns in the master passion; is energized by the will, is moulded in the mind, and ripened in the heart; so then out of the heart, through the medium of the tongue, proceeds the evil fruit of the tree of corruption.

So a master passion raging in undisputed sway, constitutes madness; an aberration of intellect is produced; reason has lost her balance, and hence insanity and infatuation, &c.

It has been asserted by some writers that diseases of the body are hereditary. I doubt this matter. Certainly disease of the soul is hereditary in all its deadening destructive power. But the remedy for sin, faith in the SIN-BEARER, is most surely not hereditary, since the Scripture says, "All men have not faith." But with regard to the other position, the Word of GOD declares "that all have sinned," that "there is none that doeth good, no, not one." But faith shines on earth with an unsteady lustre, by reason that the casket in which it is encased, is in the soul of a shattered image, in the ruin and corruption of our flesh. Yet is the jewel maintained, preserved; kept by the mighty power of GOD, as a spark of fire in an ocean of quenching waters, till faith shall give place to sight, and grace make way for glory.

In considering the diseases of our exquisitely-constructed bodily frame, may we not behold the force and truth of that Scripture, "Be sure thy sin shall find thee out"? for as disease of body, disease of soul, or sin go hand in hand, covertly or palpably, so there is the peculiar SIN of the drunkard, and there is the peculiar DISEASE attendant on drunkenness[1]. There is the SIN of prostitution, and there is the peculiar DISEASE attendant on prostitution. There is the SIN of gluttony, and its attendant DISEASE of plethora, &c. There is the SIN of midnight revelries, with vain display of person, and there is the AWFUL CONSUMPTION, swallowing up its thousands and tens of thousands in the revolution of one year; and thus does the one follow, and sometimes closely too, upon the other, the disease upon the sin; and sometimes the punishment, creeping slowly after the sin, yet, in general, and most often are they to be viewed as in fellowship, in unequal vigour, perhaps the one in the wane, by reason of exhaustion of bodily power, or both struggling for the mastery together, the conquest of either, a fatal triumph, which must end in death. Yet, amidst his sinful career, should the sinner be converted by Divine and sovereign mercy, the besetting

[1] Delirium tremens, gout, &c.

sin, by grace, is greatly subdued, yet may disease, the consequence of sin now abandoned, prevail, and the thorn in the flesh be the cause of deep humiliation till time shall be no more, and death and hell shall be swallowed up in victory.

CHAPTER II.

ADVICE, &c. ON HEALTHY URINE.

It is God alone who gives life, and who takes it away; who commands the pining sickness, and who bids it withdraw, agreeably to His own Word; "I kill, and I make alive; I wound, and I heal. The Lord maketh poor and maketh rich, He bringeth down to the pit, and bringeth up again. In whose hand is the breath of all mankind." Jesus said unto the sick man, "Jesus Christ maketh thee whole, arise, take up thy bed and walk." So God in the flesh rebuked the fever, and it vanished. He commanded the withered arm to be stretched out, and it was fresh and vigorous, and shapely as the other. He took the man with the dropsy and healed him, &c.

These things are truths eternal; nevertheless, the same God, from whom they came, also says, "They that are whole need not the physician, but they that are sick." And we know that one of His own loved apostles was taken from the number of this professional body, for St. Luke was a physician. Such men, therefore, and their remedies, according to His almighty will and everlasting purposes, are allowed to succeed as means, blessed by the Lord, who even condescends to put into the heart of the medical man remedies and plans hitherto unthought of, and the patient, also, is heard to ask for the most extraordinary article of food, which, being allowed, he swallows, and from that moment begins to recover his health. A lump of figs was the plaister God ordered to Hezekiah's boil, and this remedy was made the means of restoring that righteous monarch to his full health, his life being prolonged fifteen years.

Having premised these observations, I now desire to offer a few general remarks on the state of the Kidney, and the means whereby, with the rich blessing of the LORD, we may preserve health in this important organ, and consequent natural action of its secretions, and be enabled to judge how to act on the observation of certain symptoms. To this effect I shall divide the subject into four heads, and but slightly touch on the peculiarities incident generally to each period of life, with their accompanying derangements.

Of all the diversified secretions of the animal body, there is but one of which we can affirm that it is a drain, an excrementitious and a most important drain, from the system, and that it is not, therefore, entitled to rank, strictly speaking, as a secretion. For, we may usually receive this word under the acceptation of a fluid that is poured out, which is subservient to other important actions, and changes in the economy. Thus we see that a due supply of the secretion of saliva is needful to the proper mastication and subsequent digestion of the food received. Again, an important and, I may add, essential ingredient in the due formation of healthy chyle, and, consequently, of blood, is the addition of the usual quantum of bile; whilst the proper action of the intestinal canal could not be kept up in its various processes of absorption, of nutrition, and of casting off, when done with, the gross and useless parts of the food, if the bowels were not stimulated by the due secretion of bile and pancreatic fluid, &c.

But it may be said of the Kidneys, that they are the true water-drainers, and their secretion, the drain of the animal frame. This fluid is not only to be considered as an useless ingredient in the animal juices, but that it becomes a deadly poison if it be ever retained, for however short a space, in the economy. It is subservient to no purpose whatsoever; and, unlike the true secretions just alluded to, it is no sooner poured out, or drained off, than it passes into a receptacle, where it accumulates for an indefinite period, until its increasing bulk excites a desire in the animal to void it. This receptacle, it is known, varies in various tribes, and is even modified in different tribes of the same class of animals. In some mammalia there is a bladder, in others a peculiar dilatation of the bowel, which answers the purpose of a bladder; and in others there is scarcely any trace of either the one or the other, but merely an open duct, like the gaping mouth of the lacrymal duct in the eye of brutes and of man.

If the urinal secretion be regarded in the above light, and if it

is also remembered that this drain, unlike any other secretion, when once pent up, or altered in quantity and quality, gives rise to the most alarming and fatal diseases, how important is the duty of every individual to watch over the varied changes which this drain may be the subject of, and not allow, as is often the case, a false delicacy to prevent him giving the professional man explicit information upon the same?

In order, therefore, that I may give to the observations I am about to make upon this secretion or drain, the appearance of regularity and uniformity, I shall notice some of the most important changes in it during the several stages of infancy, childhood, adolescence, and old age, and offer a few words of advice upon their respective disorders, and the diseases incidental thereupon.

There is certainly no period of life in which the anxious care and parental solicitude of a mother for the health of her child is stronger, than when her helpless infant hangs, like the leaf on its stem, on the breast of its affectionate parent. She watches its movements, notices its cry, and yearns over the manifold weaknesses and infantile diseases of her offspring. It is indeed an interesting and an anxious period for a mother to pass through. But how agonizing is the suspicion, how distressing the idea, that the object may be swept away in a few short struggles of convulsion out of time into eternity! There is scarcely any disease that flesh is heir to which causes more alarm and awe in the minds of by-standers than that of convulsions. But when the helpless infant in the arms of its mother is suddenly seized with this frightful malady, the parent too often concludes that death must inevitably follow. I shall proceed to notice some of the leading features and causes of this distressing disease in infants. A mother who suckles her offspring is, in all probability, in the habit of indulging in highly-seasoned food and rich made dishes; the medical attendant might consider it an unpleasant task to urge her to a plainer and less luxurious diet, during so important a period as that of suckling is known to be. The continued indulgence, however, of such kinds of food tends to weaken and disorder the digestive organs of the stomach, the milk becomes poor and void of nutrition, and, in addition to this, it shortly takes on an acrid disposition, which, of course, lessens its healthy properties. The infant, in its turn, sickens. The mother erroneously supposes the babe to be out of health, but never once suspects that her own injurious way of living is the vehicle for

conveying a noxious food into the system of her infant. In vain does she attribute the derangement to teething, to worms, to disordered bowels; in vain does the professional man administer his antacid powders at bedtime; the infant grows worse, and, suddenly, it is seized with strong convulsions, heavy breathings, livid lips, and long-drawn sighs. I shall not now advise what is to be done under such circumstances, feeling assured that no mother would delay to obtain immediate professional advice. But I must be allowed to retrace my steps, and throw out my opinions upon the cause, rise, and progress of the foregoing symptoms.

Although I have only mentioned the abuse of highly-seasoned food in the mother as one of the causes of the above train of symptoms in the infant, I must not, however, confine myself to this source, for the infants of those among the lower orders who feed on any indigestible, unwholesome articles, as stale pickled fish or vegetables, salted pork, and greens, &c., and such like trash, which is cried about the streets and vended in the low neighbourhoods of this metropolis, are equally liable to this fearful complaint as those of the wealthier classes. When once, therefore, an acrid state of the fluids of the stomach and bowels sets in, the infant soon pines, frets, and is unusually peevish, refuses the breast, or if it sucks it is only to reject the milk, half-curdled, from its disordered stomach. Now if a watchful mother will notice the linen around her infant, it will be found stained of a deeper colour than has been usually observed to be the case; the urinal secretion is of a red, or ochery, or rhubarb tint, and she may, probably, notice some slight irritation and inflammation about the skin when the linen is removed. The infant will now be often observed to pass its hand across the bowels, and to cry when the lower part of the bowels is touched. If this state of disordered Kidneys and stomach be suffered to continue, and is not relieved, the secretion will not merely remain altered in quality, but its quantity will soon become diminished, and thus is it necessarily pent up in the system of the infant. When the above appearances present themselves, let the baby have five grains of calcined magnesia and two or three grains of rhubarb each night for a week; let the mother carefully abstain from all spiced, sour, or acid food; her diet should be of the plainest sort, and she should take a cupful of soda-water and milk, in equal proportions, once or twice during the day, and a seidlitz powder each morning, to promote a gentle action on the bowels. To this treatment for the infant should be added the use of that

valuable remedy, the hip bath, taking care not to allow the body to remain in the bath above seven or ten minutes, and to have the surface well dried by gentle friction with warm Welsh flannel. But the body should not be kept too warm by much clothing, and the spine, especially the lower half, should be carefully rubbed by the two hands, alternately, on each side of the back bone, until a genial glow pervades the skin of this part. This plan might be adopted for three successive nights, and then omitted for a week, and again resorted to, if the child should still exhibit symptoms of uneasiness and distress about the stomach and bowels. There are some other points worthy of notice, but which will readily present themselves to the mind of an intelligent and watchful mother, such as a rhubarb or jalap lozenge for the infant every alternate day when the stomach and bowels feel hard and tense, or putting a tea-spoonful of cream of tartar into a tea-cupful of boiled milk and arrow-root, and allowing the infant a table-spoonful of it several times a day, one hour, perhaps, before it takes the breast. I shall, however, pass over these points now, that I may consider a few of the most important and striking disorders of the Kidney in childhood.

CHAPTER III.

ADVICE, &c. ON HEALTHY URINE.

The period of teething in children is usually attended with more or less fever, and not rarely with unusual irritability and disorder of the whole system. This process being a slow and a painful one in the majority of instances, there is a corresponding progressive disturbance throughout the whole frame.

It frequently happens, that just as the period of dentition sets in, the urinary secretions are observed to be much altered, there is a red or sand-like deposit in this drain when allowed to cool and settle [1]. The child is soon noticed to be fretful and

[1] It might be remarked here, that whenever muddy urine of this description clears by heat, it is owing to a large solution of impure oil, or oil that is not suffici-

extremely peevish, rubs its gums, or is constantly putting its fingers into its mouth. When this state of disturbed function arises, the child should occasionally have administered to it a brisk purgative of rhubarb, soda, and magnesia, three grains of each at bedtime. This active remedy, continued for a few days, may prevent the occurrence of more severe symptoms, which I shall proceed to notice.

The disturbed state of the Kidneys may not be ordinarily observed by an inexperienced nurse, or young mother; it is, however, a most important symptom, because by it we may so apply our early remedies, that the subsequent ailments may possibly be warded off.

This disturbance, I may here observe, will be readily known by an inspection of the urine; that is to say, by noticing whether it gives a whitish tinge to the linen of the infant, or deposits, when cool, a milky and thicker portion, as is often found to be the case with children during teething, as well as with those who are afflicted with worms. Whenever a child is labouring under some irritability of the stomach and bowels, and there is reason to suspect it is troubled with that disagreeable complaint, worms, the urine will become thin and limpid at the outset of the attack; but as the irritation of the bowels increases, this secretion will take on the appearance of thin water-gruel, or milk that is largely diluted with water, having only a slight tinge of that colour peculiar to urine. Under these circumstances, the child should be made to take two grains of calomel and six of scammony at night, and this dose followed up by a tea-spoonful of castor-oil and oil of turpentine floating on coffee or milk the following morning; when, as is most commonly the case, the whole of these noxious substances will be voided, and the urine will resume its healthy character.

It may be supposed, however, for argument's sake, that the child's urine is not noticed in its various alterations from day to day. There is no suspicion that this drain from the system is at

ently drained by the vital action of the Kidney, together with some purpurates of ammonia and other salts, just as we observe in the case of cold beef tea, or animal broths largely diluted with water. When a solution of this kind is cold, it has a muddy and opaque character; but if heat be applied to it, the solution becomes clear, and resembles the change of the disordered urine now alluded to, with this exception, that as the one is a process carried on by a vital organ, the Kidney, and the other is a fluid manufactured by man's art, there must be necessarily some slight difference between the two products. In short it is urine loaded with oil and salts, and possessing but little water.

all affected; the child is observed merely to be out of health, and the stomach and bowels to be slightly deranged. If this state of derangement is not treated in its earlier stages, there will supervene, sooner or later, in most children a condition in the urine quite opposed to that just described; this drain is no longer thick and muddy, but clear, copious, with scarcely any tinge of shade of colour in it.

The usual salts and watery portions from oil are not drained away by the Kidneys from their respective sources, the blood and the oil of the patient. If, then, they are not sent off by these organs, they must be, necessarily, pent up in the system; and continuing to be so shut up in the circulation of the body, they give rise to the alarming symptoms of convulsions, grinding of the teeth in sleep, constant headache, and general uneasiness.

It not unfrequently happens that this state of disturbance lays the foundation of water on the brain, one of the most intractable diseases which children and infants are liable to. There can be no doubt that the constant irritability which the process of teething oftentimes keeps up in the system checks that due and copious discharge of noxious fluids from the body by its sieves, the Kidneys, which is necessary for the maintenance of health; and as, in the grown person, when the Kidneys are disturbed in their functions, and checked in their secretions, water, in the form of dropsy, is poured out into those cavities or portions of the body that are surrounded by loose and yielding walls, as the cavity of the bowels, lungs, and the muscular substance, &c.; so, also, in the yielding, unformed, and soft bones of the infant's head, the cavity of the brain, having but little support, the fluid here finds a ready vent for exudation and accumulation. Under such circumstances, the gums should not only be freely lanced by the medical practitioner, but the loins should be well rubbed night and morning, and the hip-bath employed every night for a week. If there should appear much fever about the patient, two leeches might be applied, one over each Kidney, and the drink should consist of thin barley water, flavoured with lemon peel, and acidulated with cream of tartar; an addition of rochelle salts may be made when the bowels require any aperient medicine. A tea-spoonful of the former salt, and half a tea-spoonful of the latter, in a pint of fluid, will suffice for the patient's drink. With such useful precautions, those distressing symptoms of convulsive seizures, with all their stupefying and debilitating consequences, are frequently obviated. There is no doubt that many of those

serious attacks of epilepsy in adults have had their foundation in childhood, during the process of teething; and, from ignorance or inattention on the part of parents, there has been left such an habitual sluggish state of the Kidneys, that these glands have not been, as they are intended to be, the purifiers of the blood, by draining this vital fluid of its otherwise noxious principles If these deleterious agents, that ought to be sent away in the urine, are detained in the blood, the central organ of the circulation, the heart, will soon evidence tokens of distress and labour; the child will be short of breath on any active exertion, and complain of palpitation on ascending a flight of stairs: nay more, it may so derange the circulation in the brain, that heaviness, stupor, and head-ache, may be among the frequent ailments of the young patient. Now, under such circumstances, it has been the custom, most unfortunately for the invalid, that the practitioner, as well as the parents of the child, have looked upon the head as the seat of the whole disturbance; whereas, if the Kidneys, and their functions, and secretions, were watched, and treated on a simple but rational plan, the symptoms would, in all probability, soon vanish. Leeches, baths, and friction of the spine, form the ground-work of the plan now recommended; and the parents should not be deterred from this practice, nor object to it when adopted by another person, though they may not perceive any reasonable connexion between a stupefying head-ache, a palpitating heart, and disordered secretions from the Kidneys.

It may be as well to notice, in this place, another form of nervous disorders, and oftentimes simulating epileptic seizures, which are frequently observed in children of more advanced ages, but especially so among girls between the ages of twelve and sixteen. The changes which the constitution undergoes during this period are known to be most important, and they throw a very powerful weight upon the future health of the individuals of either sex. But as the nervous system of woman is far more susceptible of derangement than that of man, so it is oftener the seat of the most obstinate and distressing symptoms. It has been too much the custom, among medical practitioners, to pass over this feature in the female constitution, and when they have been called upon to act in such affections, they have, ignorantly, asserted that nervous seizures were purely hysterical; in other words, that they were partly feigned, and partly arose from temper and irascibility of disposition. Now it is well known that such females, as I am now alluding to, are, at the onset, deranged in their general

health; the stomach loathes animal food; the bowels are torpid, and not easily acted on; bleeding of the nose frequently occurs, swelled feet and hands, cold extremities, and a constant chilly sensation along the spine and across the loins, all combine to render the patient inactive in body and mind. Let the urinary secretions be watched under the above described symptoms, and a pale, copious, limpid, and almost colourless fluid will be noticed as an attendant thereon. If the patient will attentively pursue her observations from day to day, it is probable that this colourless secretion will be noticed as long as the preceding symptoms continue. The results, however, soon manifest themselves in another distressing form; the patient begins to grow emaciated, lethargic, and heavy. The skin is chilly at the slightest change of temperature, and, instead of the once rosy, ruby tint on its surface, so highly characteristic of health, vigour, and strength, it now assumes a dirty white, or dingy tinge, and the arms and legs are but scantily supplied with hair; thus denoting the universal derangement of the superficial or cellular oil of the body. Now it is under such circumstances as these, that a formidable train of nervous symptoms may arise, and which I have seen to lay the foundation of subsequent mental imbecility, but which has been preposterously called by that hydra-headed signification, hysteria.

If the appropriate remedies be administered at an early period of this attack, the subsequently long-continued derangement of the system may be avoided. While the patient is tolerably strong, and before these debilitating symptoms set in, let her have tepid saline shower baths, in process of time to be used cold; let the loins be braced up with warm flannel, and the feet immersed in hot salt water for a quarter of an hour three times a week; give the bowels an active aperient, consisting of two tea-spoonfuls of Epsom salts, and half a tea-spoonful of calcined magnesia, every fourth morning for two weeks; and let her assiduously persevere in the use of the best preparation of carbonate of iron that can be obtained, mixed in a sufficient quantity of treacle, thick gruel, marmalade or tamarind pulp, if the bowels will bear this laxative vehicle; in order to form a confection, of which she should take a tea-spoonful three times a day.

The mineral springs of Tonbridge, Cheltenham, and Leamington, &c. &c. are admirably suited for such conditions, containing, what these waters do, the very saline and ferruginous substances, which are deficient in the blood under this disease.

Children, of both sexes, are very apt, from over-indulgence, to gorge their stomachs with an inordinate quantity of food; the bowels are oftentimes so indurated and puffed up, that, to an experienced observer, it is a matter of surprise that health should exist. Now I do not mean to infer that the Kidneys take on any disease on account of this gross habit of living, but I do affirm that, inasmuch as it is the office of these glands to separate, drain, and cast forth the noxious, useless, and excrementitious principles from such an heterogeneous mass as that which children swallow, so do these organs become incapacitated to remove all that is needful to be removed from the system.

There is no condition of childhood in which a brisk purgative from time to time becomes more efficacious than in this state; for although the accumulation is gradual, and progressive, yet the symptoms will often burst forth with an alarming aspect. On two occasions I had to see a young boy, of whom it was reported by his friends that he had become so furious and ungovernable, that they had lost all control over him. When I saw him, he was rolling about on his back in bed, hallooing, shouting, singing, and crying alternately; was perfectly conscious when spoken to, but when his attention was not diverted by any person, he would recur to his previous state. This lad passed but a scanty quantity of urine, and that too with a deep ochery tinge. There was an interval of fifteen or eighteen months between the two attacks, so that during the second one I was far from being ignorant of its cause, as I was in the original seizure. His friends could not help me in assigning any reason for the complaint, except that, in answer to some questions, there was reason to suppose from them, that the boy had been eating too heartily of late, and that his bowels were deranged in consequence. The quantity of aperient medicine this lad took, without any corresponding effect, was truly surprising; but, at length, a free action of those parts took place, and the indigestible mass which was brought away, baffles all description. The lad rapidly recovered, and the urinary secretion resumed its healthy character. Although the parents were strictly enjoined not to allow the boy to abuse his health, by feeding so enormously on any thing his fingers could lay hold on, yet a similar and a more severe attack, originating in the same cause as the former one, took place; his recovery was slower, but his mental faculties were by no means so sharp and bright as they were antecedent to these fits.

CHAPTER IV.

ADVICE, &c. ON HEALTHY URINE.

There are very many conditions of the human frame under derangement, in which an experienced nurse, or a careful and intelligent mother, is far more valuable and useful than the medical practitioner, with his drugs and potions. For although it would be highly culpable on the part of any parent to set aside the remedies which her medical attendant proffers to his patient, yet must she ever bear in mind that these nostrums are extraneous exotics in the constitution, and therefore ought not to be relied upon exclusively, to the neglect of a constant and assiduous watchfulness on her part, in administering a due quantity of nourishing food as the occasion may call for, as a prudent mother. There are many stages of a disease, in which, after all the efforts of the physician, a kind and gentle nurse is of an incalculable benefit, wherein she should learn to draw that sensible distinction which is oftentimes found in the professional man, and which raises him so highly above the mere sordid empiric; namely, the knowledge when and how to act, and when to cease from acting; in short, the not doing too much on the one hand, and yet, when requisite, being satisfied to remain a passive observer of the progress of his patient, on the other. This is, indeed, an enigma, which few in the humble walks of the profession, or in the class of nursing mothers, can learn to solve, and see the value of; yet is it not a whit the less important to learn, and to act upon also, than is the due administration of nauseous potions.

But it is time that I should give a short sketch of what is ordinarily understood among professional men by a healthy secretion from the Kidneys. The quantity from a child should average one pint and a half, whilst that of an adult should be double this quantity during twenty-four hours. In short, it it should be somewhat about one-third less in quantity to the fluids taken,

though it is impossible to lay down any fixed rule in such an action as this variable secretion is known to be. As soon as healthy urine is passed, it should present the same character as when cold. It should have no deposit, nor the least cloudiness about it. The colour should range between a light orange tint and a dark lemon shade, and the vessel in which it is contained should not be in the least degree stained. There should be no froth or bubbles of air upon the surface of healthy urine after it has stood two or three hours, for, if there are any, it denotes a sluggish and chilled state of the oils around these organs.

But there is, perhaps, no condition of disease, in which a mother can render more service to her sick child, and at the same time be the means of carrying out the wishes of the medical attendant, than when it is slowly convalescing from a protracted and debilitating complaint; as in typhus fever, small-pox, measles, scarlet fever, &c. &c. In the general derangement that the system has undergone during the above diseases, the skin and bowels form the principal seat of the disorder. The patient, under the above circumstances, may be improving in health, and the medical attendant may consider him out of danger, so that his visits are less frequent, and he confides the further care of his patient to maternal watchfulness and nursing. The mother, however, allows the child to go about the house too freely, and his delicate frame becomes chilled; he looks heavy, becomes drowsy, and his ankles are observed to puff and swell towards evening. The urine may be noticed to be scanty, and dark, and muddy, in character. His once ravenous appetite, the usual attendant of convalescence, fails him, and it soon becomes evident that something is wrong in him.

If the progress of these symptoms is not checked at an early stage, a general dropsy of the body supervenes. Permanent disease of the Kidneys sets in, and the foundation of other serious changes in the body will be the result. There is such an intimate sympathy of action between the skin and the Kidneys, that when the secretion of perspiration from the whole surface of the body has been suspended for some days, as in the eruptive diseases just alluded to, the internal organs, but more especially the Kidneys, are very liable to take on active disease. The first monitors of this change may be gathered from the appearance, as well as from the quantity, of the urinary secretion; for when the eruptive fever abates, this drain ought to assume a healthy aspect; but when we notice a muddy appearance about it, like stale or

mouldy beer, and that the bubbles of air remain on its surface, a considerable time after it is voided; if, moreover, an iron spoonful of the secretion be held over the flame of a candle, and the heat, as it boils, turn it white and flocculent, then, indeed, there is ample reason for suspecting that serious disturbance is going on in the interior of the Kidneys.

There is no remedy more efficacious, under such conditions of the system, than immediately to put the child into a warm bath; indeed, it would form an excellent plan of treatment, if, on the disappearance of the eruption in any of the above diseases, the patient was placed in such a bath, so that the skin might be solicited to return to its natural action, and thereby relieve the probable fulness of the vessels of the Kidney and bowels; whilst the dead and desquamating skin would be more readily separated from the sound skin beneath. Wherever I have seen this practice pursued, after the eruption of scarlet fever, &c. has subsided, none of those secondary, and most debilitating diseases have occurred. The patient, besides the use of the warm bath, should have a brisk aperient powder or draught, either of calomel or scammony on the one hand, or of Epsom salts in carraway water on the other. But leeches must be applied over the Kidneys if these remedies fail to relieve, and fomentations should be assiduously kept on over the region of these organs. The further consideration of this part of the subject I must leave for a subsequent chapter.

But it may be remarked, however, as a general rule, that if the urinary secretion is observed in children, or adults, to be loaded with a pink-like sediment, that a gentle action on the bowels is called for; especially if this secretion assumes such a character for several days together; whilst, on the other hand, when it is limpid, pale, and without the least sediment, an internal sluggishness of the organs, from cold, or from some other depressing influence, is going on, and this calls for rest, warm clothing around the loins, a generous diet, and wholesome air. For, let it be remembered, that as the Kidneys are the only organs in the animal body that drain away the redundant noxious humours, they will, when in healthy action, throw off a heavier, thicker, and more highly coloured urine in the morning, or after a hearty meal, than after a copious draft of diluent fluids, as tea or coffee, with fermented food, as bread, and especially rolls and new bread, &c. Their office necessarily causes them to send away a fluid which is perpetually altering in character;

and when there is no such deviation from that voided in the morning, noon, or night, but that it presents an uniformity in aspect, quantity, and quality, the Kidneys may be then suspected to be in fault, and to be deranged in their important and most intricate functions.

But it becomes an interesting question with every parent, how far the diseases of smallpox, measles, &c., may be suspected at the outset, and whether there are not some symptoms which may lead to the expectation of the threatening malady? We can only reply, that the urinary secretion, antecedent to the accession of fever, is commonly as turbid and white as thin water gruel; presenting much similarity to the urine of those persons who are afflicted with worms and such like disorders of the stomach and bowels. This secretion always assumes an altered character prior to the sickening of the child for an eruptive disease; and the white appearance now spoken of arises from too great liquidity of the oils of the Kidney, which necessarily flows away into the common drain in a larger quantity than is compatible with health.

On the other hand, when we find that a patient is passing high-coloured, red, and very turbid urine, we are sure that there is a great preponderance of saline, and very little watery, matter in it; that the Kidneys are slightly inflamed, and that the blood of the person is in a disordered condition. But, as it has been observed, this secretion oftentimes presents a character the very opposite to that now alluded to, when an hysterical paroxysm, an epileptic seizure, or an hypochondriacal attack are about to affect the system, then the saline matter is nearly absent in the urine, the fluid is pale and limpid, and the retention of those salts, and their circulation in the body, when they ought to be passed away in the excrementitious urine, give rise, doubtlessly, to these disturbed states of the nervous system in the young of both sexes. But it may happen that this character of urine, which, indeed, denotes extreme inactivity in the system, and is usually accompanied with great debility of the whole frame, is also observed in the protracted convalescence of persons afflicted with smallpox, severe fevers, &c. The treatment in the former instances, as in the latter, should consist of generous food, wine, and tonics, as steel, bark, and quinine, the mineral waters and cold shower-baths. It is a feature so striking in the character of epileptic seizures, that we may often pronounce a fit to be near at hand when we see the urine becoming thin and pale, and losing its former orange or citron coloured tint. Under such symptoms we should cup

the loins, or put a blister, in size to that of a shilling or half-crown, over one Kidney, and when that has been kept open for three or four days another should be put over the second Kidney, and the first allowed to heal, that the patient might be enabled to lie with comfort on his side, for the recumbent posture on his back will be painful with the open blister on the loins.

From repeated observations, I have no hesitation in affirming, that there is a large number of cases of epilepsy, and of those nervous affections which are all swept into one word, hysteria, but which originate from an undue action of the Kidneys, that may, moreover, be traced as cause and effect to the retention of the saline and other matters in the system, which it is the peculiar office of these organs to separate, drain off, and cast forth from the body.

CHAPTER V.

ADVICE, &c. ON HEALTHY URINE.

In a secretion like that of the urine, which forms the principal sieve for the bulk of the animal juices, it must be expected that its quality will be affected according to the variation of the food received, and of the exercise of the body; also, that it will be materially affected by sudden changes of temperature, by leaving off some of our warmer apparel; in short, whenever the skin is more or less checked in its action of perspiration. But notwithstanding these frequent and sometimes sudden deviations in the quality of the urinary secretion, there are certain periods of life in which the urine is a better prognosticator of coming evils than perhaps any other symptom which can present itself to our senses. I shall, therefore, proceed to notice a few of those diseases, and their attendant disorders of the Kidneys.

Those individuals who are of sedentary habits, and live freely upon highly-spiced viands and made dishes, and who drink liberally of the white and French wines, are most commonly the victims of gout. But prior to an attack of this painful disease

the urine is seen to put on a very striking character, and change from its former state of healthy appearance. If the vessel be carefully examined, there will be often found in the urine which is passed on rising in the morning a minute quantity of red sand, and the whole secretion intensely red, muddy, and thick, then the evidences of active derangement in the bosom of the Kidneys are unequivocal. This state is almost always the forerunner of gout, a rheumatic attack, or some disagreeable affection of the skin, as I shall shortly notice. Now when such a symptom as this one occurs, if the patient will only administer to himself a dose or two of medicine the disorder may pass off, and he may, possibly, relieve himself from a protracted sickness. He should take a three-grain blue pill, and with it a tea-spoonful of calcined magnesia, or soda, and as much rhubarb as will lie on a sixpence, dissolved in a little peppermint or cinnamon water, two hours afterwards, every other night for four times; following up this dose the next morning with a common seidlitz powder, or a tea-spoonful of Cheltenham salts, dissolved in a little fluid, to which a glass of soda-water may be added, and taken in its effervescing state.

It forms a curious feature in the derangement of the Kidneys, and one which evinces the intimate sympathy that exists between these organs and the skin, that whenever this sand-like deposit occurs in the urine, there will often arise a corresponding disturbance of the external parts of the body; blotches, boils, and scaly or scurvy eruptions break out, and the patient finds them not only most painful, but exceedingly intractable of cure. Many gentlemen who eat heartily, and drink freely of claret, champagne, or burgundy wines, soon fall victims to these disorders and to gout; but when with this inordinate quantity of solids and fluids they take very active exercise in the open air, and excite a copious and long-continued perspiration on the skin, the noxious qualities of the food received are carried out of the system, and they are often found, under such circumstances, to pursue this course with impunity for years together. But should such an alteration in their affairs take place as to prevent them from using this active exercise, the skin becomes affected with leprosy, or such like scaly disease, and the red brick-dust or sandy deposit in the urine denotes the internal derangement of these delicate and important organs. There is now an extremely irritable state of the nervous system of the person; he is impatient and peevish on the slightest occasion, has restless and

sleepless nights, loss of appetite, dulness of intellect, and a general lethargy of the whole body, mental and corporeal. The slightest cold affects him with universal chilliness of body, and if the quantity of salts in the system has not found its exit from the blood by the Kidneys, an attack of gout, or severe rheumatism, is most frequently the result. In this condition the individual should take an active saline aperient every morning for a week; he should diet himself on the plainest food, as a mutton chop, and a little weak sherry wine and water, but no green vegetables, acid fruits, or spicy viands. With this regimen, and gentle exercise on horseback, or on foot, for four hours daily, it may be the means of renewing his strength and invigorating his frame.

It has been already observed, that the appearance of bubbles or froth remaining on the surface of the urine many hours after it is voided denotes a disordered action of the Kidneys; but I must now remark that this symptom, though slightingly attended to even by medical men, may, if properly acted on, lead to many useful results in the preservation of the health of an individual. This appearance is apt to run into another and more marked change in this secretion, which consists in the formation of a greasy, unctuous pellicle on the urine when cold, having, also, when the light of the window shines upon it, a variegated colour, the preponderating tints being a pale blue, red, and green, or greenish yellow. That there is much information to be gained from this character of secretion, I have no doubt; not only from the observations at the bedside, but because we find that all the celebrated physicians, from Hippocrates to those of the present time, have laid more or less stress upon it. Indeed this eminent man wrote a chapter exclusively upon it, and the treatment to be adopted on its appearance, which would be useless as well as profitless to quote now. It may be observed, however, that the causes of it, which he mentions, seem to be pretty accurate, and to agree in the main points with the opinions of more modern writers. This greasy pellicle is seen in some disorders of the chest, but more especially in those who are disposed to consumption and diseases of a debilitating tendency. It denotes, moreover, an imperfect digestion, and that this function is, with many other vital actions of the body, more or less impaired. Quinine, sarsaparilla, especially the liquid essence of this root, steel, and tepid salt baths, are amongst some of the most useful remedies in this disordered state of the renal secretion. It would

be foreign to my present purpose to enumerate those symptoms which are observable in the more advanced stages of consumption and such like emaciating diseases, such as the pink sediment in the urine of hectic persons, the brick-dust deposit of severe fevers, and the ropy thick secretion of inflammatory attacks, as in acute rheumatism, and in some forms of dropsy, inflammation, &c. These conditions will be considered at length under the head of those diseases in which the professional man is necessarily called upon to treat. My sole object in this part of my treatise is to lay before the public a few leading features in the various changes which the secretion of urine is prone to take on, and the remedial agents, which non-professional persons may have recourse to, in order to prevent the occurrence of a more formidable derangement of the system. I cannot close these few observations upon the character of disordered renal secretion without briefly recapitulating the various modifications which this drain from the system is liable to, and recurring to the outline of a mild treatment, which any intelligent parent might innocently administer to his child, or to himself, when it is called for. It may be as well then to remark, that this fluid, when voided by a person in robust health on rising in the morning, should be clear, of the colour of a pale orange, or of amber, and give out that odour so peculiar to urine, somewhat paler after a meal in which the fluids have exceeded the solids taken, as after breakfast; but still the deeper colour first mentioned should again recur after a hearty dinner of animal food, &c. When the bowels are sluggish in their action the secretion from the Kidneys will oftentimes carry off a good deal of extraneous salts and other matters, so that the urine voided early in the morning, or during the day, may be noticed to be thicker and more opaque than natural; this slight change should not lead to the supposition that any derangement is going on in the Kidneys, but that the liver and bowels require a gentle action upon them; and if the individual takes a mild laxative draught, the muddy character of the urine will vanish.

This muddy appearance is sometimes so excessive after a hearty dinner, at which a few glasses of red wine, especially claret, have been taken, that it is apt to give rise to some uneasiness in the minds of those who are watchful of these changes in the urine. The important use of the Kidneys, it should remembered, cannot be better shown than by this appearance, for if they did not carry out of the system the obnoxious salts which are produced in the stomach during digestion of such articles of food, or bev-

erage, the results might prove very distressing. A glass of soda-water, with two tea-spoonfuls of tincture of senna, taken night and morning, will often remove the appearance here referred to.

It will happen frequently, that when the mind has been harassed, or the body fatigued by great exercise, or that the feet have become chilled by sitting too long in a current of air, or that the person has taken largely of diluent fluids and of vegetables without a proportionable quantity of animal food, the urine becomes limpid, clear, and almost colourless. If this state continues, there may be felt an aching across the loins, and a sensation of weakness and of weight about the back; flannel around the region of the Kidneys, and preserving the feet warm with lamb's wool stockings, will help to remove it; but if it continues, a hip bath, for three nights, half a tea-spoonful of carbonate of iron, in gruel or treacle, twice a day, or a glass of good port wine, two hours before dinner, with a biscuit, will invigorate the stomach, and restore the functions of the Kidney to the healthy standard. Animal food should be taken, and vegetables sparingly used, especially those that contain much oil, as greens, turnips, parsnips, &c.

Citron coloured urine, when passed, is usually observed to be quite clear, but in ten minutes it may present a thick muddy aspect, like the pale yolk of an egg beat up. The skin is here deficient in its secretion of perspirable fluids. Active exercise in the open air, for two or three hours daily, will often remove this change in the urine, without any other effort being made. The bowels are also very apt to be deranged in their functions, and to require some gentle aperients, as the seidlitz powder, in the morning. The disorder is often met with in those who lead a sedentary life, indulge a good appetite, and take but little exercise; so that the Kidneys may be said to perform the offices of the skin, as well as of their own.

The colourless limpid secretion of delicate females, as well as the same pale fluid in those habitually nervous, and incapable of much bodily or mental exertion, should be strictly watched, and, if judiciously treated, the colour and healthy character of the secretion may soon return, and strength and vigour of body be restored. Here the steel powders, wine, especially good sherry, light animal food, as a mutton chop and fowl, should be indulged in, with a very scanty allowance of those debilitating fluids, toast and water, tea, gruel, &c.

But I forbear enlarging to a tedious length upon the subject,

in this work, though, if an opportunity occurs at any future period, that I may be enabled to recur to this important inquiry, as far as it concerns the non-professional reader, I hope to bring the matter before the public notice in a more elaborate treatise, that the variety of changes which the urine is observed to undergo, from time to time, may be traced up to its corresponding causes, and the appropriate remedies and treatment adopted accordingly; whereby a train of symptoms more intractable may be warded off, and health, by the rich blessing of Him who is the Author of all our mercies, may be retained and preserved.

PART X.

CHAPTER I.

DISEASES OF THE KIDNEY, &c.

It is impossible to contemplate the subject of the physiological structure, healthy functions, and morbid processes of any one organ, or set of organs, in the animal body, without beingled to notice, also, the influence that such functions exert over other organs, equally as important and essential to life and health as they are. The average standard of health in an animal body consists in the due secretion of fluids, and in the active circulation of healthy blood and oil through the various organs which are destined for that object.

We cannot enter into the consideration of the diseases of the Kidney, for example, without being obliged to notice the important sympathy that the skin has with these glands, and the mutual re-action and sensibility which is constantly kept up between it, the stomach, the intestines, the lungs, and the Kidney.

But as the skin appears to exert a more powerful influence over these glands, and to be more intimately bound up with their health or derangement, than are other organs, I shall take a short glance at this curious and wonderful tissue in the animal body.

The skin, then, in the holy language of Eternal Truth, is a clothing, a garment, wherewith to pack up and encase the marvellous works of Him who formed man out of the dust of the ground, and breathed into his nostrils the breath of life. "Thou hast clothed me with skin and flesh, and hast fenced (hedged) me with bones and sinews," saith Job. But as in all the created objects that God has set before us, every creature, each after its kind, presents a symmetry, beauty, and grandeur, peculiar to each one ; so in the component parts of every animal, as the skin,

its hair, there are to be found mighty and wondrous traces of the infinite wisdom and power of that Mind, whose ways are past finding out, and whose thoughts are as far above our thoughts as the heavens are higher than the earth.

Now this universal covering of the body is liable to diseases, the consequence of sin, just as are the other parts of the frame; and God has permitted this portion to be the seat of a most frightful and loathsome disease, in an especial manner, called leprosy, that He might show forth by it the malignity and awful nature of the leprosy of the soul, or the soul encased and wrapped up, mummy-like, in sin, in rebellion against a holy God, in love of self, and in hatred of Him who is his Creator and Preserver. But fallen man is so wretchedly ignorant of that word which is as pure as the Author of it is pure, and is so alienated in his mind from that wisdom that is from above, and the knowledge of that holiness which is true wisdom, that he perversely shuts out the revealed mind and will of God in all his calculations and soarings after worldly profit and human praise. He sets about his plans, bent on his own selfish ends and sordid views, his inflated wisdom and self-love. But if man would bow the knee before the Majesty of Heaven, and give all glory to the God in whose hands his breath is, that gracious Being would direct his paths, for to act thus would argue that his soul was touched with the rich grace of such a God. Thus if medical men would only honour the sacred oracles by searching their pages, and humbly looking up to Him who is the Lord of light, and life, and truth, they would find ample materials therein for profitable and useful study, as it bears upon their professional duties toward their fellow-men. I need only instance here the wonderful accuracy with which the disease, leprosy, agrees with that affection so minutely traced out by God the Holy Ghost in the xivth of Leviticus. This affection, I have said, is a type, and a very wonderful type too, of the complete encasement of sin which surrounds the natural heart of man. We may take up the words of the Lord the Spirit, and speak of the scales of leprosy, as they cover the body of man, one lying over and upon the other, and say of the heart of the unconverted man, that his scales are his pride, shut up together as with a close seal; one is so near another that no air can come between them, they are joined one to the other, they stick together that they cannot be sundered. This represents his pride of heart, which is the mighty stumbling-block, wherefore he will not humble his haughty spirit into the dust

before the God of all mercies, and seek the saving, peace-making blood of the Cross of Christ Jesus the Lord. The almighty power and light of God the Holy Ghost must separate his scales of heart, and shine into the region of his darkened understanding; and thus, through this medium, create a new heart, new light, and, consequently, new affections, joys, hopes, and sorrows, &c. Old things will pass away, and, behold! all things will become new. He thus becomes a new man, created anew after the image of Him who is the first born *from* the dead, even Jehovah Jesus; and thus being brought forth by and through sovereign power and grace, for the consummation of bliss in that glory ready to be revealed, he shall soon behold his once lawful master, the god of this world, and the first-born of death, even Satan, hurled, bound with chains, into everlasting darkness.

But I must proceed to notice some of the striking features of the skin and its functions, as they bear upon the health or derangement of the Kidneys.

This covering of an animal body is a direct continuity of surface with that of the internal parts, as the mouth, stomach, and intestinal canal. It keeps up a constant separation or drain from the subcutaneous animal oils, known by the term of perspiration. This fluid is altered in quantity and in quality by exertion, by digestion, and by various diseases. It contains many salts, varying in kind and in character; carbonic acid enters into its composition, or carbon in its purer form, which is instantly converted into this acid as it stands out from the pores, minute quantities of phosphoric acid, muriate of soda, or common salt, albumen, oil, and urea[1]. On comparing this analysis of sweat with the other drain from animal oil, urine, it will be readily seen that the composition of the two fluids is similar, because the sources of the two are the same, that is to say, animal oil.

Hunter, in speaking of the skin of whales, remarks, that "the cutis seems to be the termination of the cellular membrane of the body more closely united, having similar interstices, and becoming more compact. In the change from fat to lean the skin does not undergo an alteration equal to what takes place in the adipose membrane, although it may be observed that the skin itself is diminished in thickness. In fat animals the distinction between the skin and cellular membrane is much less; the gradation from the one to the other seeming to be slower; for the cells of both

[1] Lavoisier and Seguin. Archives de Chimie.

membrane and skin being loaded with fat, the whole has the appearance of one uniform substance. This uniformity of the adipose membrane and the skin is most observable in the whale, seal, hog, and human species. In most quadrupeds it is muscular, contracting by cold, and relaxing by heat[1]."

The reticulated layers of the cellular membrane beneath the skin in the human subject send off processes, and divide the adipose structure into rounded capsules, for the insertion and nourishment of each hair. "The skin, therefore, a vascular and highly-sensible structure, is penetrated by the hair, which does not, as far as the most minute injections, with the help of glasses, can show, receive any contribution of vessels for the purpose of nourishment from it; and if there is any analogy between the structure of the human hair and that of the larger species of animals, the oleaginous secretion covering it, and giving to it its smooth and glossy appearance, is also derived from the adipose structure alluded to beneath the cutis, this fluid being conveyed along the centre of the hair by tubes which originate in the bulb[2]." What a marvellous beauty and symmetry does the infinite mind of God preserve throughout the whole of His created objects. The hair or wool of man and of brute, the feather of the bird, the scales and fins of the fish, the down on the wings of insects, and the minute bristles on the bodies of beetles and such like, together with the bark of trees, and the tough fibres of plants, are one and all nourished, sustained, and preserved by OIL.

"From a little above the bulb, as it passes up through the scalp, each hair is seen to receive an opaque membranous covering, forming a kind of sheath, which sheath can be easily traced to the surface of the scalp, and a little above it, appearing at this part as if sent off from the cuticle. In minutely injected pre-

[1] Phil. Trans., 1787.

[2] Plumbe on Diseases of the Skin.

I will venture to assert, that there is no part of an animal body which bears such strict resemblance as the feathery oil-tubes of the Kidney do to the hair of the skin; and not only in appearance does this similitude exist, but we may here see that the anatomical and physiological character of the two are very similar also. Oil passes down the feathery oil-tubes to be drained off into the bladder, and oil passes up the bulb and shaft of the hair to be evaporated and carried off, whilst, I doubt not, the whole hair is nourished by oil from the cell of the adipose membrane, just in the same manner as the quill of the bird, the scale of the fish, and bark of the plant, are nourished by oil, each after its kind.

Who does not recognise the intimate sympathy that must necessarily exist between the subcutaneous oil, and its product, hair, and the oil of the bosom of the Kidneys?

parations, vessels may be seen passing on these sheaths, and originating in the adipose capsules, having no other obvious use than the support of the sheath and the hair it contains[1]."

But it may be asked, what are the immediate effects of a sudden suppression of the various salts and other matters which the skin sends off? The first serious evil is fever, in other words, a sensation of heat and chilliness alternating; the blood is altered in chemical qualities, because those matters that should have been cast forth through the pores of the skin are thrown back upon the circulating fluids. The vital organs soon begin to suffer, headache, sickness, and general distress of body supervene. Now, from time immemorial, medical men have been contented to prescribe saline medicines in febrile attacks, but they have usually done so with a species of empirical knowledge; they may give as a reason, that they are to act on the skin, and restore its healthy balance; but I should rather argue, that in so doing they restore the healthy quantum of saline matter in the blood, and by this vital channel the skin is aided in the restoration of its healthy functions. When the delicate pores on the surface of the body are thus constricted by sudden damp, or cold, the various salts are thrown back upon the system, and seek an exit by the Kidneys. The beautifully-constructed oil-tubes and tender vessels of these bodies cannot endure the presence of these foreign salts without suffering materially in their action. The blood-vessels become inflamed, the veins pour out serum into the urine, hence albumen is detected in this secretion. If the skin, under such circumstances, is not soon brought to throw off its own fluids, and so relieve the blood of its redundant salts, &c., the result will be fever, inflammation, or dropsy. If the latter disease is set afloat, it first evidences itself in the skin of the extremities and face, then of the cellular tissue of the lungs, peritoneum, and pericardium, &c. The skin, now that the body is dropsical, is, in a sense, perfectly useless. No perspiration is seen, not even in the axillæ; its hair, the product of oil in its oil cell, is not duly nourished, and, sooner or later, it falls off; for it may be asked, who ever saw perspiration upon the body of a dropsical or a diabetic patient? Now the urine may be observed no longer to change in weight, colour, and thickness, as is the case with that of healthy persons. For although the oils of the animal body are rendered much more volatile by the vital powers of the

[1] Plumbe on Diseases of the Skin.

body than any salt in it, contrary to what is generally believed, yet the derangement above described prevents the proper drain taking place from this animal oil either in the Kidneys or in the skin, so that the blood is immediately rendered unfit for sustaining and preserving health, life, and vigour. If the fountain be impure, how can we expect the rivulets or secretions flowing out of it to be otherwise than impure? The skin thus constricted by a sudden application of cold or moisture, ceases to perform those offices for which it is so peculiarly and beautifully adapted. Its large amount of secretion, averaging six pounds and a half in twenty-four hours, is reduced to a very low quantity. Those saline and oleaginous matters, being thrown back upon the circulation, derange that delicate and wonderful apparatus, the glandular system. Under these disadvantages, the Kidney now suffers in its functions; it strives to separate and send forth the redundant salt of the blood, but commonly fails in the effort by the inflammation and general derangement which necessarily springs up in its bosom from this increased action going on within it.

Man has the greatest quantity of fat immediately beneath the skin; this oily layer answers several purposes; it furnishes oil to the minute oil-bags at the bulbs of the hair; it mingles its drain with the fluid called sweat as it oozes from its myriads of pores, and some of the oil so purified and drained of its excrementitious particles is absorbed and carried into the circulation. The mouth of these absorbing ducts is wonderfully placed within two or three lines from the root of the hair, so that whilst this product from the skin is nourished by oil, and this vital fluid is drained by perspiration, the purified oil is absorbed into the blood, as occasion may require. The physiological structure of the skin and its hair is not more interesting than is the importance of its pathological changes, for I have always found that the appearance and change of the skin and its hair has led to very many interesting facts connected with dropsy, diseased oils, and disordered Kidneys. If the subcutaneous oil is altered in quality, being either too rancid, or too fluid, or too thick, not only does the hair fall off, and the skin become of a dirty pale, or fawn colour, but the blood, and the whole system of glandular circulating oils, become involved in the general disturbance. It would form an interesting pathological investigation to ascertain the various changes which this oil of the skin is liable to, and thus to distinguish the causes of many of those inveterate and most painful

diseases of the skin, as impetigo, leprosy, psoriasis, &c., the majority of which, I am confident, have their origin in some unnatural state of the subcutaneous fat. But the inquiry, though intimately connected with my present subject, is now in its infancy, and would lead me too much astray if followed up in this part of the subject, yet I hope to be able to refer to it again at some future period, and to show the intimate union subsisting between the superficial layers of fat on an animal body and that of the deeper seated or glandular fat, as the fat around the Kidney, &c., and to set before the professional body the importance and value of the study of every change of colour, structure, and appearance of the human skin under the various diseases of the body.

I conclude this part of the subject rather abruptly, that I may at once pass on to the consideration of the several diseases or disorders of the CIRCULATING ANIMAL OILS, producing the various forms of dropsy, epilepsy, rheumatism, diabetes, and gout, &c.

CHAPTER II.

DISEASES OF THE KIDNEY, &c.

It will be readily granted, that the consideration of an animal substance, so diversified and so important to life as animal oil is known to be, ought to receive the deepest attention from the physiologist and medical practitioner, and that this fluid, which enters so largely into the composition of the life-giving blood, should be studied in its various changes or derangements, and in the manifold diseases which grow out of such alterations in its healthy character. In order, therefore, to give this subject something like uniformity, I may as well divide it into several heads; for as we find that diseases, totally opposed to each other, may spring from one source, so also it is obvious, that the causes of derangement may be dissimilar, and yet the diseases resulting therefrom may assume many similar features. I

am therefore disposed to class the various changes of structure in the Kidney under three principal divisions, which will, as I anticipate, comprehend nearly all those affections which are common to this organ. But I allude here more particularly to the system of the oil tubes of the Kidney; and, in treating of this branch of renal pathology, the following heads will form the groundwork of my future remarks. There is, then, a liability in the human Kidney to suffer from, First, a superabundance of animal oil; Secondly, a deficiency of oil; and, Thirdly, a decomposition of oil.

In the consideration, however, of the first of these three divisions of diseased oils, I am necessitated to describe it under two sections, for the following reasons. There may arise a superabundance of oil in the cells of the adipose membrane, and so a foundation be laid for a distinct form of dropsy. Whilst a similar excess may be found to exist in the circulating fluids of the body, but more especially of the blood, and thus cause a striking form of rheumatism. Both of these changes I shall now proceed to notice, calling them an excess of animal oil in the adipose cells, and an excess of animal oil in the blood.

Under the first head of this division, I am desirous of drawing the attention of the professional reader to a form of dropsy which has hitherto not received a distinct description, or a specific name, by medical authors, but which has its origin in an alteration of the oils of the body. The term BRAWNY DROPSY will, in some measure, explain the nature of this change, in contradistinction to another form of swelling, quite opposed to the one now alluded to, but which will be described shortly under the term of DOUGHY DROPSY. The patients who are usually the subjects of this disease, present the countenance of health and vigour, they are usually males, and possess a strong, bony, and muscular frame of body. The integuments are not uniformly swelled, but the legs and thighs are involved in it more than the arms and hands, or face. When the swollen parts are manipulated and grasped by the hand, it gives one the sensation of handling a piece of brawn, or the carcase of a pig that has had its bristles burnt off after its slaughter. Unlike the more common form of dropsy, the integuments do not pit when the finger is firmly pressed on them, or, if they do so, their elasticity fills up the dent that may have been made, almost immediately when the finger is withdrawn. The skin is not shining, as in the other form, but it is tense, hard, and unyielding to the touch, very similar to the

state of the integuments in elephantiasis. It oftentimes presents also the peculiar appearance known as "goose's skin," and it is furnished with abundance of hair, and is warmer and less pale than the blanched skin of those afflicted with doughy dropsy.

Aretæus was evidently acquainted with some such distinction as that now made, for he remarks, "that a dropsy, from redundancy of phlegm, arises in young robust persons; that the water stagnates between the skin and muscles[1]," whilst in anasarca it is a vitiated state of blood. Both Cælius Aurelianus, and this author, term the disease "Intercus;" because the water collected stagnates in the cellules of fat, and by that means acquires a palish colour; whereas in anasarca, in consequence of the impure state of the blood, the colour of the skin is more unseemly, and of a greenish dirty hue. When, therefore, this disease is complicated with anasarca, or, as it will be termed in the following pages, doughy dropsy, a more terrible species of dropsy is produced; since the former is only the beginning, and the latter the perfect state or height of the disorder[2].

The remark of this sensible author, is one which evidences the attention he paid to the study of diseases at the bed-side; I have repeatedly seen the severest form of brawny dropsy, after the lapse of weeks, if not relieved in the urgency of its symptoms, pass into a severe form of doughy dropsy, and then the disease has proved fatal in a very short time. The five distinctions of dropsy, which are made in Dr. Copeland's Medical Dictionary, may be reduced thus: the first two belong to the disease now under consideration; the last two to doughy dropsy, whilst the middle one is œdema, from phlebitis, phlegmasia dolens, or from obstructed glands, &c.

This disease, then, derives its characteristic features from a pathological change in the subcutaneous oil, which keeps up a reciprocal morbid action in the Kidneys, and their oils. It is most commonly met with in men between the ages of forty and sixty, and rarely before or after that period of life[3]. The habits of the

[1] It is not merely a stagnation of water from suppressed perspiration, and deficient draining in the Kidneys, but it is a stagnation of the circulating glandular oils of the body.

[2] Lib. ii. cap. 1.

[3] There are, however, some exceptions to this rule; for I have witnessed a few instances of this form of disease in young men. I lately saw a boy of twelve years of age, and a young woman of twenty, both of whom suffered from a most severe form of this disease, so that the girth of the thigh in the latter instance measured thirty-three inches. They were both of them fatal in their results.

individuals so attacked are not necessarily intemperate, that is to say, they do not take ardent spirits in any quantity; but, on the contrary, they are usually addicted to good living, eating freely of animal food, which a dram-drinker rarely craves after, and drinking largely of malt liquor. I have observed, also, that those who are attacked with this form of dropsy have a well-formed and strong bony fabric of body, and are rather square built plethoric men, averaging five feet eight or ten inches in height. The disease can rarely be traced to any previous organic changes in the body, as from diseased heart, liver, or Kidney, but it occurs somewhat suddenly, at a time when the individual thinks himself in the enjoyment of excellent health. Those persons who are, or have been, at some previous time of their life, prone to lustiness, or obesity, are very liable to this intractable complaint[1].

The occurrence of the disease is ordinarily ushered in with the following changes. The individual has probably been taking a hearty meal, and has gone to work, or has otherwise exerted himself, so that the skin is made to perspire freely, in this state he has become exposed to a current of cold air, or to a shower of rain, so that he is sensible of a chill over his body; now the urine will become very muddy, high-coloured, and rise six or eight degrees in its specific gravity. He is, however, ignorant, perhaps, of this change, and he continues to work, because he does not feel "ill all over," and he is unwilling to think himself an invalid. If the Kidneys were to lose blood by cupping on the loins at this critical period, there is every probability that the patient would not ultimately become dropsical. Another cause of this disease, is often found to arise from the individual having used some active exertion, and brought on, thereby, a copious perspiration, and in this condition has partaken largely of some cold diluent fluid, and has then exposed himself to a current of cold or damp air. But, whatever the cause of the obstruction may spring from, the effects are, under all circumstances, pretty much the same. The skin, with its myriads of pores, is suspended in its functions; the two grand drains from animal oil, the sweat and the urine, become deficient, altered,

[1] In one case of a man, fifty years of age, suffering from the disease, this fact was very striking. He had several brothers, who together with himself were large, bony, and strong built men; they were all very prone to lustiness, nay even some to obesity; and the patient now alluded to weighed seventeen stone, three years before his illness.

or deranged; the circulating glandular oil of the Kidney passes into the blood in an impure and watery state; the saline matters of this vital fluid are also disordered, and hence the heat and febrile excitement of the patient at the outset of the attack. The urine, as I have remarked, is scanty, very high coloured, and muddy, clearing by heat, containing no albumen, and highly acid. There is not much complaint made of lumbago, but only an aching across the Kidneys. The surface of the body rises in its temperature, and the integuments are oftentimes of a board-like hardness, and so tense, that the pressure with the finger gives pain to the person, though not to the patient. There is a thickening of the abdominal parietes, but fluctuation is rarely detected in this cavity; the thickening alluded to having its origin in the swelling of the oil cells of the cellular membrane between the muscles, and not from any effusion of fluid into the serous cavity of the abdomen. The ancles, calves of the legs, and the most fleshy parts of the thighs, are the first to become swelled. The countenance betrays no distress, or internal disease of vital organs, as may be frequently seen in the doughy form of dropsy. The arms and face are rarely involved in the swelling during the earlier stages of the disease. If a needle is used to puncture these brawny legs, no fluid follows, which is the reverse in the other form of the disease: the reason is obvious; for the oil cells are loaded with a thick and impure, or inspissated oil; and not with water and a deficiency of oil, as in the doughy form, so that the serum can no more escape, than can blood from a vein in venesection, when a lump of fat intervenes, and chokes up the orifice in the arm.

The liver, and consequently the bowels, are torpid, but the appetite is not much impaired. Such is a brief outline of this malady, and I beg leave to refer my readers to a well-marked instance of it in the CLINICAL CASES, No. 1.

CHAPTER III.

DISEASES OF THE KIDNEY, &c.

But I must now offer a few remarks upon the pathology of this disease, as it regards the internal organs, but more especially of that of the Kidney. It has been already stated, that the source of the attack might be invariably traced to a preponderance of oil in the cells of the adipose membrane, and in the log of renal oil. The individual, prior to his attack, finds himself growing stout and lusty; this increase of size depends upon increased deposits of fat in the various cells of the cellular membrane. The subcutaneous adipose tissue, and the larger cavities, as well as the heart, &c. become so many beds for fresh depositions of fat. The oil cells are, at length, so crowded by the innumerable and increased quantity of the globules of oil, that the healthy circulation of this fluid is retarded.

During this sluggish state of the fluids, the blood does not receive its due supply of healthy and pure oil from the superficial and deep-seated oil-ducts, or lymphatics. The blood, thus clogged in its progress through the various minute tissues of the body, and unable to overcome the obstruction which surrounds its capillary vessels, exudes its serous, or watery globules, into these bloated oil cells. Whilst this effort is being made on the part of the blood in its vessels, the surface of the limbs presents an extraordinary degree of hardness. But when these changes have gone through their first stages, and the capillaries are in some measure relieved, the board-like hardness of the limbs diminishes, and the brawny character of the surface somewhat disappears.

But during the progress of these changes in the oil and in the blood, there are others of a more serious nature going forward simultaneously in and around the Kidneys. These wonderful organs, the main purifiers of animal oil, become inclosed and

imbedded in their own fat; their tubular portions are encroached upon, and impacted by, shapeless masses of fat. This unnatural growth within and around parts so exquisitely delicate in structure, and so highly important in function, produce most serious disturbances in the action of the whole organ. Many instances have occurred where the tubular structure of the Kidney was supplanted by huge lumps of this hypertrophied fat, and nothing remained around them but a small portion of the vascular substance of the organ. Such preparations I have now in my possession, where the brawny dropsy terminated fatally.

The vascular substance, under such circumstances, is crimped, hardened, and very red, with a yellowish tinge, or ground. It answers to the first of the three divisions of diseased Kidney given by Dr. Bright, in the following words:—" In the first a state of degeneracy exists, which, from its appearance might be regarded as little more than simple debility of the organ (anœmia) In this case the Kidney loses its usual firmness, becomes of a yellow mottled appearance, and, when a section is made, nearly the same yellow colour is seen to pervade the whole of the cortical part, and the tubular portions are of a brighter colour than natural. The size of the Kidney is not materially altered, nor is there any obvious morbid deposit." In the most advanced state of the disease, Dr. Bright thinks there is a more decided alteration of structure, and that some portions are consolidated, so as to admit of very partial circulation, in which case the surface has a somewhat tuberculated appearance; the projections being paler than the rest, and at this period the urine is coagulable[1]. I cannot say that I have found the last statement respecting the urine to be an invariable fact, yet I can readily believe that it is as the doctor asserts. Had this eminent physician been aware of the important office of the animal oil within the Kidney, and of the anatomical structure and physiological uses of the feathery oil tubes of this organ, his valuable researches upon the diseases of this gland would have been proportionably interesting.

When this diseased state of the Kidney supervenes, the blood becomes poisoned from the various salts, which this organ should drain away, being retained in it. Urea then circulates, head-ache, and disturbed mental faculties creep on. Palpitation and emphysema, with its consequent dyspnœa and hydrothorax, shortly

[1] Dr. Bright's Med. Reports.

set in, and thus the case becomes more and more aggravated, and is less under the control of remedial agents, and at length the patient sinks from some internal effusion.

But I should have remarked, that the liver becomes, in the majority of cases, the seat of fatty accumulations also; hence a greasy or caseous liver is by no means an uncommon pathological feature in this fatal disease. The heart, from the impeded circulation of the liver, becomes thin in its walls, and dilated in its cavities, fat accumulates around its base and apex, and small fatty pendulous bodies are occasionally met with on its semilunar and mitral valves.

With respect to the treatment of this form of dropsy, it may be observed, that in most instances, as far as my observation goes, an uniform antiphlogistic plan will answer best. When the medical man has the charge of his patient in the early stages of the disease, he should bleed him from the arm somewhat copiously, and as soon as the system rallies in some measure from it, he should follow up the depletion by cupping him to ten or twelve ounces from the region of the Kidneys, and administer some brisk saline purgatives, keep him on low diet, and allow him to drink freely of lemonade with cream of tartar, ordinarily termed "imperial." The alkaline carbonates with digitalis and blue pill are very advantageous in this stage. He should allow his patient a warm bath two or three times a week, or, if this cannot be procured, let him have an oblong cradle-like wicker basket made, with a board at the feet, and open at the other end for the head, a hole made in this board to admit an iron tube will complete the apparatus; to the other end of the tube a spirit lamp should be placed, and thus, as he lies in bed, a hot-air bath can be administered to him. This is a very valuable remedy when duly applied, and will oftentimes excite a free action of the skin when diaphoretics have failed, so that the Kidneys have been relieved of their congestion, and the dropsy has gradually disappeared. If the disease should not yield under the above treatment, ten to twenty minims of turpentine, in the form of an emulsion, has frequently succeeded in arresting its further progress. Slight friction over the Kidneys, and hip baths, are also highly serviceable.

Before I conclude this head of diseased oils, there are other minor alterations in this vital fluid to be noticed, which give rise to painful and troublesome complaints, which are frequently far more intractable than those which involve the life of the patient.

The disorders alluded to are certain diseases of the skin, which originate in a superabundance and rancidity of oil in the subcutaneous cellular tissue; amongst these may be mentioned that troublesome malady, in strong and vigorous children, called porrigo. The eruption originates from disorder in the oil and oil cells of the skin. This animal substance becomes corrosive or pungent in its character, and gives rise to most offensive acrid discharges. It is constantly met with among the children of the lower classes, where cleanliness of person is not properly attended to. When a hair is pulled out, the root or bulb is found diminished in bulk, and the extremity of it nipped off, as though it had become ulcerated and destroyed. This arises from the deficient nourishment which it receives from the oil-cell, into which each bulb passes; or it may be caused by the acrid nature of the oil, which ulcerates, and wastes the delicate root.

"No separation of the hair is distinguished on a superficial view of the disease, but it is retained in its place after it has ceased to receive nourishment by the adhesive properties of the secretion. The adipose structure described as secreting the hair undergoes a considerable diminution or wasting, as the effect of the ceaseless irritation and discharge from the surface of the scalp while the hair is for the most part extirpated [1]."

The "scalled head," as this disease is popularly called, occurs also in robust, hearty children, and is another derangement of the oil-cells of the skin. The acrid secretion is to be corrected by cutting the hair as short as possible, and not by shaving it, as this plan excites great irritability of the surface; by washing the part frequently with castile soap, and then by sprinkling over the whole eruption some cool, moist, and heavy flour, as the oil contained in the wheat is most salutary in such diseases of the skin.

The forms of lichen, strophulus, and prurigo, especially come under the above pathological description. This class of eruptive diseases also depends upon a change in the character and quality of the oil and its cells, which exerts a corresponding diseased influence on the hair. "For there can be no doubt that the hairs have their origin completely beneath the under surface of the cutis, and derive their support immediately from the adipose membrane here disposed, and apparently having a particular arrangement for this purpose [2]."

[1] Plumbe on Diseases of the Skin. [2] Ibid.

It is a matter of surprise that professional men have not hitherto taken up the consideration of the diseases of the skin and its growth, hair, in connection with those changes and disorders of the subcutaneous oil, which it is well known occur at particular periods of life, and in particular spots of the body; showing, as I conceive, that the animal oils not only alter in quality or chemical composition at various stages of life, but that the respective deposits of this animal substance vary in their character and properties in the different parts of the same individual. Thus, for example, the changes in the oil of the skin may induce grey hair on the head, at the age of twenty or thirty, whilst the whiskers remain unchanged from their original colour, and we know that the hair on the scalp changes in colour, or falls off sooner than the same growth from any other portion of the human skin.

But I leave this matter for the future consideration of some other members of the profession, whose opportunities of watching eruptive diseases, and whose talents lead them more particularly to the study of this branch of pathology, than fall to my lot in this Institution; and I now hasten to consider, briefly, a second form of disease arising from superabundance of animal oil.

CHAPTER IV.

DISEASES OF THE KIDNEY, &c.

It has been remarked in the preceding pages, that an unnatural prevalence of animal oil in the blood is the foundation and source of that painful affection of the joints, tendons, and ligaments, known as rheumatic fever, or acute rheumatism. The symptoms of the disease are too well known to require any mention of them in this work, but it will be as well to remark, that none are exempt from its ravages, and at no age of life can an individual be pronounced free from its attacks; notwithstanding which it does, however, affect those who are hearty, fat, and strong, especially between the ages of fifteen and forty, more commonly than

at any of those periods before or beyond these ages. It also seems to be rather more common in the male than in the female.

The reasons why the joints are principally attacked in this disease are the following. There is a more intimate communication between the internal parts of these cavities and the surrounding ligamentous structures, oil-ducts, and adipose membrane than in any other part of the body. The office of these oil-ducts is to pour out and preserve an equal balance of lubricating joint oil for these delicate surfaces. When any sudden acridity and excess of the oil of the blood occurs, the joint oils must be necessarily implicated in the derangement of the circulating fluids. The surface of the skin that does not cover the joints carries off much of this acrid fluid by the channels of the pores, in the way of perspiration, and, consequently, there is not much pain felt over fleshy parts, but as the surfaces of joints perspire but scantily, in comparison with other parts of the body, the acrid fluids of the joint oils are not so readily cast forth. The joints, in fact, are formed like so many little or large circles in the body, around and within which, these oil-ducts and capillary vessels freely inosculate, and a similar anastomoses, to the same extent and in the same manner, cannot be traced in any part of the body.

I am inclined to think that this painful disease requires for its origin a stout and hearty state of constitution, but that the immediate cause of the attack is to be found in some sudden suppression of the drains from animal oil, the skin or the Kidneys, or both, and that then the blood receives an acrid and non-purified oil for circulation, in which the stearine or crystallizable principle predominates, hence the peculiar buffy character of the crassamentum when blood is drawn in this acute disease. Why some joints are affected more than others, and why some are not involved at all in the disease, I have already argued in a former part of this treatise.

The usual means, then, whereby the disease is lighted up in the system are, a sudden check to the secretion of the skin, as from getting wet in the feet, and then allowing the moisture to remain for some time in contact with the body, or in becoming wet through on a cloudy day, when the atmosphere is very heavy, and the sky lowering. If under any of these circumstances the body is not in active exercise, and its surface becomes chilled, an acrid state of the animal oils supervenes, rigors, fever, heat, pain, and swelling of the ankles and knees will soon manifest themselves in regular succession. A red blush is observed over

the inflamed joints, a hard bounding pulse, a dirty white fur is on the tongue, and the urine is scanty and very high coloured, loaded with pink, red, and ropy sediments, so that the vessel is deeply stained by it, and there is a superabundance of acid, which turns the litmus paper to a bright red, and its spec. grav. is raised six or eight degrees. Now this urine is clear when voided by the patient, but as soon as it cools its turbid character appears: if it be again heated artificially, the turbidity will pass off, and the liquid will be once more clear. I have remarked before that this phenomenon is to be solely attributed to the presence of decomposed, unpurified animal oil, from the oil-tubes of the Kidney.

This form of rheumatism is exquisitely painful, and the sufferings of the patient are usually more aggravated when the skin perspires profusely. It will often happen that this tense and red condition of the coverings of joints will last throughout the attack, and no effusion of fluid is seen to take place, but it must be allowed on the other hand that the oil-ducts around the joints in this form of disease cannot continue any length of time without relieving themselves by effusion of fluid around and within the capsules of the joints, if not previously relieved by remedial agents, rendering these coverings distended and fluctuating. Hence we may often notice that, in the latter stages of this acute form of rheumatism, it becomes implicated with serous effusion around the joints, and especially so if the patient has suffered from one or more attacks of the same nature at any former period of his life. The joints in these acute attacks are perfectly incapable of flexion, owing to the excessive pain which the slightest motion creates in them; not so, however, is it with the milder form of this disease, denominated serous rheumatism, for in this affection the joint, although surrounded by a bag of fluid, is flexible to a great extent without inconvenience to the patient. Whence arises this difference? It may be answered, that in the former disease the deep and superficial oil-ducts, that is to say, those that lie upon the surface of the synovial membrane, and afford the lubricating joint oil, as well as those that communicate freely with them, and are scattered throughout the ligamentous bands of the joint, are equally inflamed, from the acrid nature of their contents, oil. But it is far otherwise in the serous form; here the oil-ducts of the bursæ of the joints and their tendons are only implicated, the cavity of the joint itself is free from disturbance, consequently there is but little pain when its two surfaces are made to ride over one another, as in the act

of flexion. The same effect which immediately followed the first-mentioned also follows this second disorder of the human oils. Suppression of the fluids of perspiration throws the skin, with its myriads of pores, into confusion and disorder. In brawny dropsy the primary effects are scarcely felt elsewhere but in the oil cells of the adipose tissue, but in this disease, the fluid oil, no longer finding its way through the pores of the skin, and the drain of oil from the Kidney being much deranged and checked in its operations, passes in excess into the circulating blood, not however, as rich, generous, life-giving oil, but as an acrid, and, I might add, acid oil, probably. The two channels for its admission into this fluid are the countless oil-ducts of the skin, and the semicircular oil-tubes of the Kidney. Thus the vital current is struck at. An acid fluid flows in its channels, which lays the foundation of repeated attacks of this painful affection, and in all probability involves in the disturbance one or more organs, the due action of which is essential to life and comfort. No sooner have the elements of perspiration passed into the blood than a powerful reaction is lighted up within. Now the patient becomes bathed in a sour sweat, which casts forth an insufferably acrid fœtor, his skin gets begrimed with dirt. The heart heaves under its intolerable burden, the arteries expand and bound under the fingers, and the pains become most excruciating, the large quantities of salt sent off from the renal oil and venous blood oftentimes produce ardor urinæ and slight urethral discharge; for those open-mouthed oil-ducts, falsely called absorbents [1], situated at the bulbous portion of the urethra, and whose office should be to lubricate the membrane of this canal with thick, glairy, oleaginous fluid, become, in like manner, disturbed in their functions, and the protecting sheath of oily liquor is not deposited, so that slight inflammation ensues.

In allusion to the acrid nature of the animal oils in rheumatism, and of the wonderful sympathy that exists between the joints, their oils, and the skin, I may here relate an illustrative fact. It is well known that the skin has the power of sending out of the system any deleterious or noxious substances that may have been introduced into the circulating mass by the mouth or lungs. A case was communicated to Sir Henry Halford, where a young lady, during an attack of acute rheumatism, perspired a light green fluid on the toes and feet. The fluid was collected

[1] See Cruikshanks on the Absorbents.

by her medical attendant, Mr. Prichard, and examined by a practical and scientific chemist, when he detected siliceous matter and small spangles of copper. It appeared, on examining the culinary vessels, that the one in which the young lady's breakfast of milk was regularly prepared had lost one half of its tin covering, and the copper was left exposed. A day or two prior to this discovery the mother of the patient had drawn the attention of the medical gentleman to the swollen state of her tongue, and he then suggested that she must have eaten some poisonous food. He then asks, "Was the poison gradually introduced into the system in the form of an acetate?" I would also put a question to the medical practitioner, Was not the slow introduction of the acrid poison into the blood the sole cause of the acute attack of rheumatism in a girl previously "under much general debility for months?" I apprehend that the system became tainted, and the oils decomposed by this slow poison, and that the remedial efforts of the constitution were to be traced in the profuse green perspiration of the feet[1].

I must now pass on to notice some of the alarming symptoms that are apt to supervene during an attack of rheumatism. The serous membranes are more prone to inflammation in this disease than any other tissue of the body. It may be remarked that these coverings are composed of an innumerable series of reticulated vessels carrying white lymph, or oil, and on this account their contents are not recognizable by the eye during their healthy state. An impeded or disturbed flow of this limpid fluid through such hair-like channels is one of the earliest signs of disease. The cause of this derangement in their circulation must be traced up to the altered condition of the fluids, and to the unequal distribution of oil throughout the general system. But why the pericardium should be more frequently the seat of acute inflammation in rheumatism than other serous surfaces, I confess I do not know, unless it is owing to the larger quantity of fat, and, consequently, larger number of oil-ducts around and within the layers of this membrane and the heart than are to be found in the dura mater, pleura, peritoneum, or tunica albuginea. There is a greater similitude too between the structure of a joint and that of the heart with its investing membrane, than, perhaps, in any other organ of the body, as far, at least, as animal oil is concerned in that structure. The joint has oil within it, and a

[1] Med. Gaz. for 1832.

dense fibrous tissue without it, the pericardium lies upon a bed of fat and muscle, surrounded by a firm and tough fibrous coat. But other reasons might present themselves to an experienced practitioner: suffice it now to observe, that whenever the heart becomes involved in the general disturbance, the unnatural stimulus of the altered character of its contents, blood, may be regarded as the immediate agent in this distress. For just as "this fountain of life" becomes thin, pale, and weak, from a diminution of oil in the blood, as in chlorosis, and amenorrhœa, and some forms of dropsy shortly to be noticed, so does this organ labour under distress when there is an excess of acrid oil in the circulation. The internal lining of the cavities of this muscle is the first spot in which the inflammation is set up, especially in that part of the membrane where the two layers, the auricular and ventricular, meet to form their respective valves.

But setting aside the foregoing explanations of the disease, pericarditis; there can be no doubt that many instances of this inflammation arise where there is no corresponding alteration in the valves or internal lining of the heart itself. Why the left side of the heart should become the seat of morbid changes in its valves, cordæ tendineæ, and muscular substance so frequently, when the right cavities altogether escape, is a problem not yet solved by pathologists, yet I cannot but think that the function of respiration now conduces to excite disease and heighten it when once lighted up; for we often witness injurious results in disease to flow from actions that are essential to life, but which, in rude health, do not occur. Thus the stomach under fever is unable to receive that nutritious food, bread or meat, and if the patient could swallow either, the process of digesting it would only aggravate his febrile symptoms; yet are they both conducive to health and vigour, but the stomach, with its numerous wheels within wheels, is out of order, and the whole machinery is clogged, distress and confusion prevail, so that what was once its balsam is now its poison. In the same manner does every organ of the body under such a disease become incapable of performing that function for which the Eternal Hand framed and fashioned it, and bid it go forward. So the acrid oily blood arrives at the right side of the heart, and is from thence oxygenized by its flow through the lungs, and instead of becoming on the left side a better fluid for the inflamed heart to bear with, it is in this respect a more pernicious one; for the arterialization of venous blood has rendered this fluid more stimulating than when it circulated as thick, oily,

and non-oxygenized, or venous blood. Whether the heart becomes involved in the disease or not, it rarely happens, however, that the Kidneys remain unaltered in character after repeated attacks of rheumatism. The circulation of oil within the interior of these organs, and the drain that should be kept up from moment to moment, cannot but be influenced by the frequent derangements of this animal substance, oil. The feathery oil-tubes are the first parts to take on disease. By referring to the course of these tubes in the chapter where their anatomical description is given, it will be seen that the majority of these tubes fall into the urinary ducts throughout the vascular portion of the gland, consequently it should not surprise us when we find, as is always the case, that this part of the organ is the first to present an impervious, white, and non-vascular appearance. This forms the basis of the first stage of an albuminous or Bright's Kidney, the further consideration of which I shall shortly resume.

CHAPTER V.

DISEASES OF THE KIDNEY, &c.

There is no doubt that the earthy deposits around the joints of rheumatic and gouty patients originate from a diseased condition of the lubricating oil of these cavities, and there is further, a striking analogy between them and the cheesy, atheromatous, cartilaginous, and bony deposits so constantly met with over the various surfaces of the large blood-vessels and valves of the heart. This idea is strengthened by the researches of Messrs. Chevreuil and Braconnet, who prove that the incrustations of rheumatic joints are, primarily, of a sebaceo-cirous nature. This substance is produced by the action of oil, an acid, and water. But as long as the morbid influence of the blood upon them and the joint oil continues, these deposits undergo other changes, which render them more compact and brittle, and give them the character of earthy matter. For this sebaceo-cirous substance,

procured from animal oil in the human subject, like that obtained by the action of a weak acid upon mutton suet, has such an affinity for, and unites so readily with, alkaline bases, that it will separate an alkali from its carbonate, as lime, and unite with it in the form of a soapy or waxy substance. This leads me to notice that the immediate cause of acute rheumatism is the circulation of acrid, and, perhaps, I might say, acid animal oil. The chronic form of this disease, with all its painful sequelæ of nodular, chalky deposits around the smaller joints, and the consequent stiffness of these parts, originates from a formation and deposition of sebaceous, or cirous, or earthy incrustations over the flexible articulations of a limb. I am induced to believe, from numerous observations made upon this disease in all its stages, that where a powerful alkaline treatment has been kept up the patient does not become, ultimately, such a sufferer from these depositions as he would do if a milder and less alkaline form of treatment had been adopted. The valuable influence of colchicum, in arresting this disease, may be attributed to its active, alkaline base, veratria. But this drug is discarded by many practitioners, and condemned as valueless in rheumatism; the fact, however, is this, that from the careless manner in which it is cultivated, or from the injudicious mode of preparing its various formulæ, or from inattention to the precise time of the year for gathering the drug, the alkaline power and activity of its base is materially injured and weakened, nay more, in many instances it is very doubtful whether the vital principle of this article has not become dead, and, consequently, inert.

There is a circumstance worthy of remark in the exhibition of active doses of colchicum in acute rheumatism. This drug will often relieve the excruciating pains of the patient in a "silent and secret manner," to use the expression of an eminent physician. I was struck with this remarkable influence of colchicum many years ago at St. Bartholomew's hospital. Patients were admitted with the most severe forms of this complaint, the skin profusely sweating, the fœtor thereof intolerable, the countenance bathed in greasy clammy perspiration, and not a joint free from pain. The inspissated juice of Battley was ordinarily given in the form of an extract, and in fifteen or twenty-four hours we found the patients comparatively free from pain. On inquiry whether the medicine had purged freely, the answer was almost invariably, no it had not, and thus were we contented to agree that the drug had had a secret and a silent effect upon the

disorder. But, since that period, I have had opportunities of watching this fact, and it has almost invariably happened, that where colchicum has manifestly relieved the pains, without purgation, there has been an inordinate flow of urine, and of perspiration. The former of these drains from oil, has no longer presented the red, muddy, ropy character of the acute stage, but has assumed a pale, limpid, lemon-coloured tint, and has become eight or ten degrees lighter in spec. grav. than it had prior to the administration of the drug; that is to say it has fallen from 1,024 or 28 to 1,008 or 10.

It is then the alkaline basis in this, and other such vegetables, as morphia in opium, strychnia in nux vomica, &c. which constitutes its specific action and power. Hence they have been termed "alkaloids," and, amongst this class of vegetable quintessences,' if the expression may be used, modern chemistry has placed a frightful list of deadly and poisonous agents, for the unskilful and inexperienced practitioner to lay his fingers on, and to wield, alas! too often at the imminent risk of his patients' health or life. For no sooner does a young man start forth into the medical arena of public practice, than he becomes so indifferent in the consideration of the drugs he employs, that he vainly anticipates a panacea in delphinia, aconitine, or strychnia, to the exclusion of drugs more innocent and efficacious. The source of this evil has its foundation in his ignorance of the symptoms, or carelessness in the study of his patient's case; for, did he but investigate the cause of his patient's suffering, he might find that the acute head-ache, for which a large dose of morphia was administered, or the nervous pain, for which a grain or more of aconitine was employed, would have yielded to an alterative dose of colocynth or Rufus's pill, and a bitter but gently laxative draught. But, alas! this simplicity of medical practice, this steady and ceaseless exhibition of the same set of drugs month after month, year after year, do not suit the scientific researches of our modern learners in medicine. "Vain man would be wise, though he is born as a wild ass's colt." Surely the same drugs, that have been the instruments, in the hands of a gracious God, of alleviating the sufferings of our forefathers, will equally apply, with all their efficacy, to the same diseases of the present day. Time alters not diseases, but it often happens, in our day, that remedies do, and so aggravate those that were simple, that a fresh train of symptoms are called up by the deleterious compounds administered. We may indeed exclaim of such

novices, "He that increaseth knowledge (unsanctified), increaseth sorrow, for in much wisdom is much grief." (Eccles.) It is, however, a comfort and a consolation to know, that in the minds of the experienced and talented physicians of our hospitals this ignorance and empiricism find no genial soil for growth, and hence we have the satisfaction and pleasure of witnessing the solid, clear, and judicious practice of the one, as compared with the variable, shifting, experimental, unequal, and most dangerous practice of the other. As far as my own observations extend, the above remarks are any thing but overstrained, and I hesitate not to affirm, that a more talented, discreet, and honourable body of men are not to be found in the profession, than is met with in the medical department of our public charities in this metropolis.

But, to return to the consideration of the treatment of rheumatic fever and chronic disease of the lubricating joint oils. With respect to the former, it may be observed, that the disease, as above described, will often put on such a serious character, involving organs, the delicate and equal action of which is essential to life, that some more active remedy even than colchicum is required. Where we have every reason to suspect that the heart, or its investing membrane, or the pleura, have become involved in the general derangement of the blood and its oils, a steady and persevering administration of calomel and opium, until the gums are slightly affected, should be immediately resorted to, with intermediate doses of some convenient and active form of colchicum. There can be no doubt, that to the practised ear of a physician, the early evidences of pericarditis are readily detected by auscultation. These evidences will be made known either by a deep-seated murmur, or by a sharp whizzing sound at the contraction of the left ventricle. If, however, the external as well as the internal lining of the heart becomes involved in the inflammation; the "new leather," "to and fro," or "attrition sound," first described by Dr. Stokes, and subsequently followed out in all its various results by other eminent physicians, will manifest itself at some period or other of the attack. Like œgophony in acute pleurisy, this morbid sound of the heart is unfavourable in the early stages of the disease, and most favourable during the progress of convalescence; for, in the former instance, it denotes that effusion is going forward, whilst, in the latter periods of the disease, its return, after some days' absence, is an evidence that the solid, or fibrinous shreds of the fluid, are

in process of organization, in order that they should form the medium of connexion and adhesion between the heart and its serous covering; the invariable result of serous inflammation.

Independent of the value of the alkaloid drug, colchicum, in the acute form of rheumatism, there is no doubt that the exhibition of alkaline salts, during the sweating stage of this disease, is attended with great advantage and benefit to the patient. But, notwithstanding their value, and the manifold blessings that result from their use, it would be injudicious, nay dangerous, to rely wholly upon them, when we have unequivocal signs of internal inflammation of some one or more vital organs. Bleeding generally and locally, with active doses of calomel and opium, must then be actively employed; the operation of cupping beneath the left mamma, is the most simple and convenient form of taking blood locally, and has many advantages over depletion from the arm, or leeches to the præcordia.

The exhibition of liq. potassæ, in the subacute forms of rheumatism, has also been attended with great advantages; but I have noticed that its remedial powers have been co-existent with a marked alteration and improvement in the character of the urine; for this drain has lost its turbid and red appearance, and has assumed the more natural colour of an ochery or citrine tint. Those persons to whom this alkali did not afford decided relief, were almost invariably secreting a pale, limpid, and clear urine, with a very low specific gravity, scarcely amounting to a higher degree than 1,010; and the peculiar alteration in weight of this secretion, from time to time during the day, as observed in rude health, was not noticed in the cases here alluded to.

I have witnessed a few instances, in which the use of the alkaline earth, lime, has been of decided benefit to the stiff and nodular points of rheumatic patients[1]. Equal parts of fresh lime and arrow root, being triturated into a very fine powder, a pinch of this substance has been rubbed gently over the joints, night and morning, for the space of five or ten minutes. The patients have regained the flexibility of the parts, and have been enabled to cut their bread and meat, and feed themselves, after suffering from stiff and useless joints for many months. But I must now proceed to notice, at greater length, the obstinate and chronic form of disease, which is so frequently observed to follow an acute attack of rheumatism; and, as other important and not less

[1] Vide Appendix, No. 3.

serious changes take place in the lubricating joint oils in this disease, as well as the former one, I shall treat of the same, under another title, which will distinguish its character and nature from those changes in the economy that arise from an excess and acridity of the circulating animal oils[1].

CHAPTER VI.

DISEASES OF THE KIDNEY, &c.

There is another form of dropsy, which is far more frequent in occurrence than that which has been already described under the first division of diseased animal oils, and this form of anasarcous swelling has its foundation in a DEFICIENCY of the circulating oils. But, before I proceed to notice the characteristic features of this disease, I must recur for a short time to the chronic form of rheumatism, in which malady there is also an alteration in the quality as well as deficiency in the quantity of the circulating and lubricating joint oils of the body.

It frequently happens, then, that acute rheumatism leaves the smaller joints of the hands and feet, but especially the former, in a stiffened or motionless condition. This change around them lays the foundation of future attacks of rheumatism, or, in other words, of inflammation of the oil-ducts of the joint. Fresh depositions of solidified oil supervene, until a joint, or the whole series of joints, are locked, and quite passive in their flexibility. Now it happens, when this disease is the result of the acute attack of rheumatism, that as soon as the patient has returned to the habits and occupation of health, there is manifested, sooner or later, a disposition in the economy to cease to secrete fat. The individual will shortly return to his medical attendant, complaining of stiffness, and even immobility, of several joints of the hands and wrists, &c., he grows thin, his appetite is, notwithstanding, tolerably good, and he enjoys excellent bodily health, yet he does

[1] Vide Appendix, Clinical Cases, No. 7.

not fatten. His urine, when examined, is very pale, sometimes even, when the case is advanced in disease, almost colourless, and very limpid, and averaging in its specific gravity 1,008 to 1,012, but rarely advancing above the latter weight. This secretion, moreover, is not observed to alter in quantity and in quality after meals, or when fasting, as is the case in rude health. The individual makes but little complaint, only that his joints are stiff, that he has lumbago, and flying rheumatic pains about him, especially about his hips and loins. The disease is doubtless established, that is to say, deficiency in the secretion of fat, which is a diseased action, is here commenced. The drain from the renal fat consumes the log of oil around the Kidney, the drain is not supplied by fresh depositions of fat from the animal body, and thus does the system become affected from a scarcity of circulating oil. The powerful acrid nature and acidifying influence of the oil and blood in acute rheumatism, have destroyed the rich, generous unction which these vital fluids ought to possess, in order to carry on health and vigour. Hence it soon happens that the blood becomes thin, the skin is pale, and unhealthy in character and in colour. The hair of the legs, arms, and even of the head, falls off, and the patient creeps about with a stick, like a tottering old man of fourscore years [1].

During the period that he is a sufferer from these changes in the animal economy, he may probably have a sharp accession of local pain, as in an attack of sciatica or lumbago.

It should be remembered, that the Kidneys lie in a space from which a set of nerves come off in a triangular form. 1st. The external cutaneous; 2nd. The ileo-scrotal, or spermatic; 3rd. The inguinno-cutaneous. When, therefore, the Kidneys are not duly lubricated with anointing oil, within and without, these parts suffer more or less from the deficiency of renal fat, and attrition of the surfaces, as the patient moves along, is attended with severe pain, hence probably his lumbago. He now becomes further troubled with cold feet, one of the constant symptoms of deficient renal oil. The hair of the hands and wrists is gone, the skin becomes shrivelled, and its fissures are deeper, larger, and more marked than in health; in short, its aspect resembles the dingy colour of chlorotic females, or of those afflicted with malignant uterine disease. The fingers and toes are seen to stick out, and, if not immoveable, are only capable of very limited

[1] Vide Appendix, Case 9.

flexion; they are tapering in their ends, the cushions of fat at their extremities are removed or diminished, and the various joints present a knotted appearance. Co-existent with these changes, the patient may, perchance, become quite bald, and his countenance assumes an appearance of old age. Thus, then, it may be explained: the blood is deprived of its due quantity of oil.

The chief reservoir or fountain, the Kidney, is deficient in its supplies; the oil-ducts around the several joints have become blocked up, a new deposition of silicious and sebaceo-cirous matter forms around them; the synovial fluid, or joint oil, has ceased to be poured out, and the several articulations of the limb are consequently locked, and motionless[1].

It is worthy of remark here, that in procuring whale oil, the oil is pale if the heat be low, but of a deep colour if the heat be great. So also I may apply this fact to the processes going on in health or in disease within the Kidney; if there is much oil, there is also heat, vigour, and active circulation. The urine is high coloured, and there is a genial glow of heat around the Kidneys, which is the essence of strength and health. But it is far otherwise when the urine is pale and watery. The animal heat of the body is then at a lower standard than in health, the oil is scanty, the blood is poor, the joints are feeble, and the urine is pale. These evidences will form a good means of judging of the state of the Kidney and of its oil.

Whenever such cases present themselves to the practitioner, he will usually find that the pain is either materially relieved or aggravated by warmth in bed. If the former symptom is present, none of those remedies which contain an active alkaline base should be administered; among them we may reckon colchicum, ipecacuanha, henbane, &c., the basis of which, as veratria, emetin, and conine, are alkaline, and exert a very prejudicial influence on the disease in question; whilst those substances which

[1] It must not be forgotten, however, that by far the most serious changes and disturbances are produced in the renal oil, and its circulation, by old and neglected strictures of the urethra; indeed, there is much reason to suppose that many individuals would not have been subject to gout and chronic rheumatism, but from this cause operating upon the actions of the Kidneys and their appendages. When this narrowing of the urinary canal is allowed to advance, the urine becomes limpid, and clear as water, there is more or less stilliciddium urinæ, lumbago, head-ache, and dizziness of the eyes. It is quite remarkable, how many cases of epileptic fits, together with convulsions, coma, and death, from suppressed urinary secretion, and consequent circulation of the elements of this drain from oil and blood, I have traced up to old and almost impervious strictures in men of middle ages in life.

The two cases in the Appendix, Nos. 8 and 9, are striking examples of this fact.

contain a pungent vegetable acid and oil, exert a peculiar efficacy on this morbid change in the system; amongst these snbstances I may mention guaiacum, juniper, oil of turpentine. The first mentioned drug should be given in form of the tincture, and in drachm doses three times a day. Twenty drops of turpentine in emulsion, is the most suitable mode of exhibiting this remedy [1].

But it is remarkable, that although the acrid alkaline vegetables alluded to are injurious in this form of rheumatism, yet alkaline or saline salts, exert a powerful influence upon it. Thus the iodide of potassium, the various saline springs, especially those of Bath, are oftentimes the means of relieving the patient to a very striking degree. But even these remedies act through the medium of the Kidneys. They set up an increased flow of secretion, and, by some inherent power, carry off the redundant and acrid fluids of the animal economy by the urine, and so afford relief to the patient.

On the other hand, if the disease be the "cold rheumatism," by which, it is understood, that the patient's sufferings are mitigated by cold, as by a light covering at night, and by a dry cold atmosphere, &c., the fibrous tissues of joints, the periosteum, ligaments, and tendons are, more or less, involved in the disease, and require one or more of the three vegetables mentioned above. Small doses, however, of calomel and opium for four or six nights are highly beneficial. This cold form of rheumatism rarely, if ever, produces concretions around the joints, and the reason is obvious to my mind: where these substances form, there is an excess of lime, partially acidified in the oil and in the blood; but in the last described form of rheumatism, there is more or less disorganization of the bones and ligaments, &c., so that they describe their pains as though dogs or rats were gnawing them. This is, doubtless, often connected with an original syphilitic taint of the system, and from debauchery, and it is set forth by God, the Holy Ghost, through His servant Job, where he speaks of the miserable life of the wicked. "His bones are full of the sin of his youth, which shall lie down with

[1] The woods of guaiacum, juniper, and oak, and a great many others, if reduced to dry shavings, and carefully distilled in a retort, yield a limpid reddish liquor, which is very acid, somewhat oily, and has a good deal of the smell of a herring dried in the smoke; and the liquid, thus prepared, is strongly acid, and the virtue is perfectly singular in carrying off, by its stimulating powers, noxious humours by sweat and urine. If, in these menstruums, therefore, the medicinal virtues of the plant exist, the solutions become exceedingly efficacious, as they act by their subtle, penetrating, singular acid.—*Dr. James's Dictionary.*

him in the dust." Such individuals are indeed doomed, for the most part, to an early death, for the whole constitution is so shattered and shaken to its foundation, that the very remedies of calomel and opium, which are here required, only tend, at the same time, to debilitate the patient; and consumption, with grey hairs, leads him to a premature death, and mortality is clothed upon by immortality. It is indeed a cankered constitution, the rust or sin of which shall be a witness against him, and shall eat up his flesh as it were fire, if sovereign grace pluck him not as a brand from the burning, and clothe his soul in the matchless garment of CHRIST's righteousness, ere he passes into the endless ages of an eternal world.

It has been already shown, that the colouring principle in urine is oil. As this substance degenerates, or becomes less rich, so do we find its drain limpid and colourless. The cause of these alterations is obvious. The renal fat is diminished, and is not supplied from the general system in a sufficient quantity to compensate for the continual draining which the secretion of urine keeps up. The bulk of the urine, therefore, is water, with a slight portion of saline matter in it. There have been but few opportunities of examining the state of the Kidneys after death, as the changes here referred to are rarely fatal; but one individual, admitted with severe sciatica, and in whom all the above symptoms were present, was attacked with fever, and died. In this case the renal fat was gone. The reflected membrane peeled off as though it had been pasted on the flesh. The oil-tubes of the vascular portion of the organs were white and impervious; not, as I conceive, that they were blocked up with concrete oil, as in the granulated Kidney shortly to be noticed, but that they were removed or absorbed, as a secondary effect to the absence of oily matter around and within them.

I may here observe also, that this scarcity of oil around the Kidney, and its limited quantity in the circulation, induces many similar results in the progress of other diseases. In short, I am persuaded, that struma, cancer, and many such malignant diseases, are co-existent with a derangement and deficiency of the renal and other circulating oils.

Thus we have the pale, clear, and light urine in many scrophulous abscesses, strumous diseases of the joints, &c. One instance is now before me, wherein a boy has laboured under diseased knee-joint for many months, his urine presents all the unchangeable characters of the chronic rheumatic patients.

A fountain or spring, sending forth the purest water, runs away into ten thousand various currents; if upon a clean and fresh bottom we should, therefore, naturally expect that each rivulet would be as pure in its nature as that at the spring head. Look, for instance, at the clear, rapid, and crystal-like rivulets among the mountains of Wales, and trace them up to their varied sources, whether on Plynlimmon's height, or the cradle of the Cader, or the peak of Snowdon, each one at its source is not purer than its various offsprings. We have but a few principles in water which renders this fluid so wholesome and so sweet. We have but a few principles in "the life," "the blood," which renders it, that which it is, the life-giving food of the body. Let, however, a portion of iron be introduced into the spring of these rivulets, would not the experienced chemist readily detect its presence in any one of its several currents? So then, I argue, if any one of the principles of blood, which is the life of the flesh, as water is the life of the earth, becomes altered, deteriorated, or lessened, what rivulet in the frame may not become implicated in the disorder? and what an endless chain and catalogue of disorders or diseases are instantly lighted up in the animal economy! What, for example, is the wasting, deceitful consumption? What the tumid, burning erysipelas? What the raging, fierce, and parching fever?

If, then, we can detect so few principles in the blood, and these too are of vital importance, who can say what the disorders are, to which an alteration in the chemical character of this fluid leads on. We know that all nature must fall down and submit "to the life." She must be and is influenced by the life of the body in the aggregate, whether that invisible and marvellous principle be found in the river of the mineral, in the sap of the vegetable, or in the blood of the animal kingdoms. If this mighty lever to her countless engines and wheels, floodgates and canals, pipes and ducts, hinges and bolts, be lacking oil, how can the precious lamp of earthly fire thrive and keep bright and beaming? But who art Thou, the great, the wondrous-working Master Spring? Who art Thou, the secret, the invisible, the Almighty Lever of these ten million times ten million levers? O it is JEHOVAH, the LORD GOD ALMIGHTY, the great, the good, the terrible. The One that inhabiteth eternity. He who fills heaven and earth. He in whose hands is the soul of every living thing, and the breath of all mankind. O that men would fall down in the dust, before this glorious and fearful name, "the LORD his

God."—"Before Him the pillars of heaven tremble, and are astonished at His reproof. Hell is naked before Him, and destruction hath no covering. He divideth the sea with His power, and by His understanding He smiteth through the proud. By His Spirit He hath garnished the heavens. His hand hath formed the crooked serpent. Lo! these are part of His ways: but how little a portion is heard of Him? but the thunder of His power who can understand?"

O Thou infinitely wise, infinitely holy, and infinitely powerful God, whither shall I flee from Thy presence and from Thy all-piercing eye? If I ascend up into heaven, Thou art there; if I make my bed in hell, behold! Thou art there. If I take the wings of the morning, and dwell in the uttermost parts of the sea, even there shall Thy hand lead me, and Thy right hand shall hold me. The darkness and the light are both alike to Thee. But for ever adored be Thy blessed name, the right hand of Thy righteousness is Thyself, even Thou, O God of our salvation, Christ Jesus the Lord. Sweet are Thy promises, and faithful is Thy word. "Fear thou not, for I am with thee; be not dismayed, for I am thy God. I will strengthen thee, yea, I will help thee, yea, I will uphold thee with the right hand of my righteousness." Where and who art thou then? the scoffing infidel, the foul-mouthed blasphemer, the reasoning deist, the God-man hating Socinian, and the popish idolater, who art thou, O unbelief, thou great mountain? before Zerubbabel thou shalt become a plain. "Behold, He cometh with clouds, and ten thousand of His saints, and every eye shall see Him, and they also which pierced Him; and all kindreds of the earth shall wail because of Him. The kings of the earth, and the great men, and the rich men, and the chief captains, and the mighty men, and every bondman, and every free man, shall hide themselves in the dens and in the rocks of the mountains, and shall say to the mountains and rocks, Fall on us, and hide us from the face of Him that sitteth on the throne, and from the wrath of the Lamb, for the day of His wrath is coming, and who shall be able to stand?"

Look at this fearful picture, then, ye lovers of this world and haters of this dreadful God. Ye idolizers of man, and his inflated wisdom, who art thou, O puny worm, insect of an hour, stalking in vain show through this scene of life's shadowy time. Talk no more so exceeding proudly; let not arrogancy come out of your mouth, for the Lord is a God of knowledge,

and by Him actions are weighed. Canst thou tell, O worm, with all thy self-satisfied wisdom and crude calculations, how the bones do grow in the womb of her that is with child? even so, then, thy God declares that thou knowest not the works of Him who maketh all.

CHAPTER VII.

DISEASES OF THE KIDNEY, &c.

I NOW proceed to the consideration of the serious and fatal disease already referred to, and which originates in a deficiency of animal oil, giving rise to a debility of the whole system, to an impoverished state of the blood, and hence to a form of disease which will be designated DOUGHY DROPSY.

I shall give the definition of this disease shortly, but it may be first noticed, that the character of constitution in which it is most apt to occur has received the appellation of cachexia, or a cachectic and leucophlegmatic habit of body. The ancient writers on medicine were well informed upon this subject, and have left us descriptions of the disease that are not surpassed in accuracy and conciseness by any of the modern medical authors. Aretæus has given a clear and a most excellent description of the disease under the title of leucophlegmasia[1], &c.

The application of the term "doughy" to the form of dropsy now to be described, is made, inasmuch, as it presents to the mind the characteristic feature of the disease, and with it, the essential distinction of this from the former kind of dropsy. Anasarca can never be considered an idiopathic or original disease; it is the result of morbid action somewhere, and yet the brawny dropsy at its outset is nearer in its alliance to an idiopathic disease than most changes in the animal economy.

The term then of doughy dropsy is given to express the peculiar feature of the swelling. If the fingers press upon the

[1] Aretæus, lib. ii.

enlarged limb, they sink into the swelling, and the pit, so made, may be filled up immediately, by again pressing a little above or below this space, and thus can the fluid be moved from one spot to another. In short, it yields like a lump of well-kneaded dough when pressed by the fingers. This disease prevails more in women than in men. The subjects of it have often suffered from acute rheumatism, or from some disease produced by a superabundance of oil, though this is by no means a rule. The countenance betokens much distress, more of grief or sorrow than of actual pain; there is usually a serious morbid change in the valvular apparatus of the heart, in the lobules of the liver, and in the oil-tubes of the Kidneys. The origins of these changes will be shortly adverted to. The eyelids are puffy and semi-transparent, the skin feels soft, is dusky, yet shining, perfectly dry, though not harsh to the hand, and without the least perspiration upon it; the extremities are quite free from hair, the integuments glisten, and present a pearly lustre, having, sometimes, a few scattered spots of an eruption like psora, or purpura, upon them. The faculties of the mind are dull, the temper irritable, the sight impaired, and, if much employed in reading, writing, or in sewing, the head begins to ache, and pain or constriction is felt around the temples and forehead. The sleep is disturbed by unpleasant dreams, or else by sudden attacks of headache, or of hemicrania, or of pain over one eye. There may be slight deafness, and ringing in the ears. The nails become dry, brittle, and chip off, they are also flattened on their middle surfaces, and turned back at their edges, just the reverse of the adunque nails in consumptive persons; they are, moreover, begrimed with dirt, and the whole hand looks like that of a notorious sot. The appetite is very fickle, the patient cannot fancy solid food, especially animal food, but seeks to be supplied plentifully with acid and cooling drinks, as lemonade, &c. The bowels partake of this caprice, and their evacuations are muddy, clay-coloured, and deficient in healthy bile. The urine is pale, slightly muddy, not unlike mouldy small beer, is found to be loaded with albumen in the early stages of the disease, though this symptom is, on no account, to be relied upon. The specific gravity of this drain will vary between 1·008 and 1·012. There may be a slight attack of hæmaturia from time to time, and hence the symptom of albuminous urine has been overrated by some, whilst it has been undervalued or wholly neglected by others. Now the fact is, that the symptom

albumen in the urine will often disappear whilst the case is becoming more and more urgent, and thus it perplexes and confuses the mind of the practitioner and the future treatment of the case. Reliance is not to be placed so much upon the presence or absence of albumen in the urine, as upon the unalterable, limpid, and colourless character and weight of this drain morning, noon, and night.

The heart, when listened to by the naked ear, or by the stethoscope, is found beating with a feeble impulse, and attended with a faint sound, the jugulars are more or less distended, the lungs emphyumatous, and the expectoration consists of a thin gum-like fluid. The patient requires a high pillow, and is uneasy in the recumbent posture [1].

There is tenderness over the liver, and this organ is usually congested in its portal circulation; there is also pain on pressure over the Kidneys. The feet are apt to remain very cold, and the patient requires more than his ordinary clothing to keep him at all warm and comfortable. Fluctuation is detected sooner or later in the abdomen [2], which is an outline of the features of doughy dropsy.

I now proceed to speak of its pathology.

A deficiency in the drain of renal oil, and a suppression of other natural drains, as the perspiration, catamenia, &c., form the steps to a progressive alteration in the oil-tubes of the Kidney. There is, at the same time, a scarcity of oleaginous matter in the general system, arising from a vitiated state of the organs of

[1] The heart presents this morbid alteration only when it has not been previously involved in disease of its valves by a former attack of rheumatic pericarditis. The change alluded to above is brought on by slow, yet serious alterations in the whole set of oil-tubes of the Kidney, which, from their impervious nature, leave the blood and oil undrained of their salts, urea, and uric acid, &c. The heart is dilated in its cavities, and attenuated in its walls. It is a flabby and feeble heart.

[2] I might here proceed to give a description of the progress of amenorrhœa, chlorosis, or anœmia. But as the changes in these diseases are so very similar, under a milder form, to those above, I must here pass them over, observing by the way, that the heart in such diseases of females is increased in irritability, from the altered state of its stimulus, the blood. When this fluid enters the cardiac cavities, the muscular walls of the heart jerk out the blood by sudden and sharp impulses, and thus give rise either to a murmur, puff, whiz, or bellows-like sound, which will ordinarily vanish under the judicious exhibition and steady perseverance of steel tonics, and a generous diet. But how often such females have been considered the subjects of diseased heart, and treated accordingly by their medical attendants, I will not attempt to affirm, but that it forms a fruitful source of error in judgment, and, consequently, of most injudicious and dangerous treatment, I have repeatedly witnessed.

digestion, and from a depraved condition of the subcutaneous fat. Abuse in taking green vegetables, spirituous drinks, and but little animal food, in keeping late hours, and in becoming exposed to sudden changes of temperature whilst the body is hot and sweating, and, lastly, by allowing the surface of the skin to become so coated with a viscid compound of dirt, perspiration, and dust, that the pores of this delicate covering of the body cannot emit the healthy and most necessary secretion or drain from the system. The blood now becomes thin and watery, and of a lower temperature than in robust health. Whenever I have had an opportunity of testing this vital fluid, it has been found below 98°; in one instance it was 95°, in which case the blood drawn from the vein was made up of five-eighths of serum, and the remainder of a thin, pasty coagulum, without a vestige of buff or albuminous shred on its surface[1].

Throughout the whole body the oil cells exchange their contents for water, because of the imperfect manner in which the log of renal oil is drained of its water, owing to the renal disease of the oil-tubes of the Kidney; so does it necessarily follow that the blood is overcharged with watery oil, and the vessels allow this water or serous fluid to escape from them and form dropsy. Hence the tenuity of this serum allows us to press the water from cell to cell, and this yielding nature of the swelling gives the characteristic feature to the disease. If the limbs, under such a condition, are punctured, unlike the results in brawny dropsy, pearly globules of water flow out instantly, and continue to do so for many hours or even days. The absence of saline and oily matter in the

[1] It might be remarked here, that in describing any disease we may run up from the symptoms which constitute the disease, to the change of structure in the fluids or in the solids, which gives rise to the symptoms; or we may take up the consideration of the organic changes in the body, and run down to the several symptoms which such changes give birth to. The former is the easiest, plainest, and most comprehensible mode of proceeding. But I must now remark, however, that if an individual should happen to get wet through, and sit or work in his damp clothes for some hours, the slow but certain alteration of structure in the oil-tubes of the Kidney will ordinarily follow. The individual becomes dropsical, his urine highly albuminous, scanty, and may be, somewhat bloody. Under these early symptoms, Dr. Christison, in his recent work, remarks that the blood is found to be more buffed and cupped than in any other disorder. Should the disease advance, unchecked by remedial agents, a chronic, pale, dirty white, and impervious state of the whole series of the renal oil-tubes supervenes. The blood then suffers as above described, and gets thin and poor, and contains but little fibrine. The first stage of the disease is ushered in by an excess of oil passing into the blood, creating inflammatory symptoms, whilst the second or latter stages are known by a deficiency of oil in the Kidney, and, consequently, in the blood.

urine, and along the mucous surface of the bladder, urethra, and intestines, during the latter stages, renders the bladder and rectum so irritable, that the sphincter of one viscus cannot act without calling the other into action instantly, and thus there is often an involuntary action of both sphincters at the same moment.

Co-existent with this escape of watery fluid from the blood into the oil cells of the adipose membrane, there is also a similar fluid pervading the oil-ducts, falsely termed lymphatics. The pleura, peritoneum, and pericardium are wholly made up of such white oil-ducts; these conduits become distressed, sooner or later, by the altered nature of their contents. For the great feature of healthy blood has now lost its cohesiveness. This power can only remain as long as the blood is supplied with rich and purified oil; the base of its cohesive property. When a thinner fluid than the oily white lymph circulates in and through the capillary oil-ducts, the watery portion of their contents will readily escape, and collecting in larger and larger quantities in the respective serous cavities of the body, hydrothorax, hydrops-pericardii, or ascites, are the sure and certain results. Hence it often follows that the abdomen will become as distended in forty-eight hours after the operation of tapping as it was prior to this operation[1].

CHAPTER VIII.

DISEASES OF THE KIDNEY, &c.

In the prosecution of my studies upon the two forms of dropsy which have been hitherto considered throughout these pages, I have satisfied myself that the peculiar character of the disease, now under consideration, is to be attributed to the absence of stearine in the circulating oils. This substance is conveyed into the blood from the renal fat, and we may often notice fatal cases of doughy dropsy where the subcutaneous fat has not become,

[1] Vide Appendix, Case 2.

manifestly, diminished, though it may be loaded with water, yet is there, on the other hand, a total absence of fat or suet around the two Kidneys. Hence the oil in the blood, instead of being suety, and giving to the coagulum of the latter fluid a fibrinous and tough consistence when cold, is wholly made up of elaine only, so that the cohesion of its component parts is lost, and the readiness of its aqueous portion to escape is, consequently, facilitated.

The oil-ducts in and over the serous surfaces are very liable to partial attacks of inflammation, leaving a patch here and there of adhesive bands, or of thickened membrane. This is especially to be noticed over the pericardium, and these white spots have often misled experienced pathologists to the conclusion, or at least to the suspicion, that acute inflammation of the membrane had occurred during a former period of life, and that they were of a rheumatic origin. But certain it is that they may be repeatedly found in the bodies of those who have died from dropsy, and who have never been attacked with rheumatism, as well as in notorious drunkards who may have met with sudden death from a fractured skull, or from delirium tremens following close upon a slight bruise or sprain. The truth, however, is this, that the external as well as the internal lining of the heart undergoes, simultaneously, a morbid change. The velvety-red inner membrane of this organ and of its large vessels, as well as the pericardiac patches, are from one and the same cause. Oil, tinged with the colouring principle of the blood in the oil-ducts, gives rise to the first-mentioned change; the oil-ducts, thickened, and foreign matter, probably organized albumen, deposited on the serous surface, produces the latter change. It has been observed, that the atheromatous or sebaceo-cirous deposits along the area of the aorta, &c., not only resemble these white patches, but that they also arise from the same morbid process in the minute oil or capillary tubes of the contiguous parts.

I must hasten, however, to the consideration of the most important changes in this disease; these are the morbid processes that go forward in the bosom of the Kidney, producing portal congestion of the liver, ascites, and cardiac dilatation. It may be necessary to remind the professional reader once more, that the majority of the feathery oil tubes in the Kidney adjoin and fall into the urinary ducts in the vascular portion of the organ, and that very few of these oil-tubes are adjunctive to the ducts throughout the tubular part of the gland. If the circulating

glandular oil, that enters the interior of the Kidney for purification, or to be drained, in other words, becomes inspissated, from whatsoever cause, it will necessarily follow that the minute extremities of these tubes in the vascular portion of the Kidney, become blocked up by the concretion thus formed. Extreme turgescence of the whole organ immediately ensues, the blood vessels are loaded, the malpighian bodies lose their natural paleness, and are, more or less, sanguineous in colour. The tubular portions assume a chocolate tinge, the whole gland swells, and is flabby in consistence; the oil is of a dark ochery colour, and the blood remains universally fluid after death, giving a red tinge to its vessels. This rapid and fatal change constitutes the first stage of the disease, so ably described by Dr. Bright. The patient is oftentimes carried off by a sudden attack of convulsions, and there is bloody urine, delirium, urinous breath, coma, epilepsy, and speedy dissolution. In these instances the blood is as much poisoned by the deleterious fluid that passes into it, as well as by what is retained in its vessels, as is the blood of the Indian who dies from the bite of a venomous reptile. The very vitals are at once struck at, and the life-giving property of the blood is destroyed, and, consequently, its power of coagulating ceases with a cessation of its life. The Kidneys, under such circumstances, present a deep modena red in colour, and are highly injectible. The urinary ducts may be filled in many parts, if not throughout their course, from a successful injection of the renal vein[1].

It may however happen, that, by a judicious line of practice, which the God of all means is pleased to bless, the patient rallies out of this alarming state. Active depletion over the Kidneys, and from the arm, a sharp dose or two of calomel, colocynth, or scammony, with a large turpentine enema, may unload the turgid vessels of the intestines and of the Kidney, and give the necessary impetus for the fluids to go forward, so that all may end well.

There seems to be some analogy in this sudden and fatal disease to that in horses, which has received the name of "molten grease," and as the description of its rise and progress is very much to the present purpose, I shall quote at length the best account which is given of this dangerous disease in that useful animal.

"Most of the writers in farriery have reckoned the melting of

[1] Vide Appendix, Case 6.

the grease as an original distemper in horses, but it will happen to horses from full feeding, and to some from the natural constitution of their blood and juices. That there is such a thing as melting of the grease, is pretty evident from what may be observed of some excessive fat horses, that have been worked in hot weather, and have died raging mad of fevers, in which case the fat is melted and turned into an oil, and is drawn off from its proper cells into the blood vessels, of which I have given a very extraordinary instance. Where a horse voids greasy matter with his dung, his grease is said to be melted; but, it may be observed, that this symptom proceeds from various causes; sometimes very fat horses, that stand much in the stable, and have but little exercise, will void greasy matter along with their dung on exposure to cold; but this is only a natural secretion, and is not attended with those inward perturbations that must unavoidably happen where the grease is really dissolved and melted.

"The swelling of the limbs, and the running at the heels, sometimes of a briny salt humour, somewhat of an oily consistence, or a thick white matter, like melted tallow, called the grease, has no relation at all to that distemper, only when there is some manifest tokens that the horse's grease has been previously melted by some hard usage; for we often see lean horses, of poor sizy blood, as much troubled with these symptoms as any other[1]. Now the true symptoms of molten grease may be discovered by the following observations:—No horse can easily have his grease melted in any degree, unless he be somewhat overcharged with fat; neither can a fat horse have his grease melted in any degree, without violence, especially by hard riding, or working in very hot weather. For the oiliness that we often observe in the dung of very fat horses, especially if a ball of his dung be thrown into cold water, proceeds only from a superabundance of oily particles in his blood, which are more or

[1] The blood of diabetic persons is often found to present a milky appearance, this change resides in the serum of this fluid, and is owing to an excess of fatty matter in it; but the alteration may be also noticed in those who enjoy tolerable health, and in animals it is met with, when they have been fed largely on animal food, to the exclusion of much vegetable matter. It is, in all these cases, an excess of the elaine of animal fat.

Etmuller mentions cases of diabetes, where a pinguious substance was passed dissolved in the urine. Dr. Lister observed, that in many of those afflicted with this fatal disorder, the urine was chylous, or milky. I believe these changes are to be solely attributed to a diseased action of the renal oils, constituting the main feature in the above disorder.

less discharged by all the grosser secretions. But when horses' grease is really melted, it is always accompanied with a fever, heat, restlessness, starting, tremors, great sickness, shortness of breath, and sometimes with the symptoms of the pleurisy. His dung will then be extremely greasy, and will fall into a scouring, not unlike the greasy diarrhœæ that happen to men in somewhat similar circumstances. His blood will have a thick skin of fat over it, when cold, of a white or yellow hue, but chiefly the latter, from the obstructions usually in the liver. The congealed part, or sediment, is commonly a mixture of size and grease, which makes it so exceeding slippery, that scarce any part of it will adhere to one's fingers, and the small portion of serum in it feels slippery and clammy, not unlike the juice of apples[1]."

He advises the exhibition of an oily enema to clear the intestines of large quantities of greasy matter. The blood is so stagnant and thick, that it is apt to run into lumpy coagulations. In swelled heels of horses, diuretics do better than purges. This, I suppose, is a species of rheumatism, and colchicum acts more expeditiously in the cure of this disease in the human subject when it is diuretic, than when it is purgative in its action.

The disease here called molten grease, is unquestionably a disordered action of the whole mass of the circulating oils; and the immediate cause of this derangement may be attributed to an undue liquefaction and acridity of this vital fluid. The unhealthy state of the urine in this disease of the horse, is very similar to that morbid change which we notice in the early stages of the disease in the human subject, just referred to. The whole intestinal canal pours out a gelatiniform, unctuous, or mucoid substance, under the circumstances above-mentioned; the result of a diseased drain from the caul, mesentery, and appendices epiploicæ of the intestines, and their peritoneal coverings. When this spontaneous and profuse purging of shreddy matter occurs in the human subject, as is the case in the molten grease of the

[1] Gibson on Diseases of Horses.

A case is related in the Edinburgh Med. Essays, vol. v. p. 652, of a man who, after a strain from lifting a heavy vessel, passed a whitish substance, the size of a walnut, like tallow, or hardened marrow, composed of small globules, and melting by heat; they continued to come away as large as this, and as small as peas. He continued unable to follow his work at the period the case was reported, (viz. three months from the strain.)

Two similar cases are also related in Prout's Gulstonian Lectures, Med. G. vol. viii. 1831.

horse, the disease assumes a less formidable aspect, and the result is, ordinarily, slow convalescence from it.

The blood of individuals labouring under this sudden engorgement of the vessels, and this acrid circulation of oil within the Kidney, is highly buffed and cupped when drawn from a vein. This change is always to be attributed to a preponderance of the crystallizable principle of animal oil in the vital current of the body. The fatty matters that enter the circulation are not properly drained of their excrementitious fluids, the stearine of oil passes into the veins of the Kidney, and into the subcutaneous vessels in an increased quantity, so that the gluey particles of the blood, or, as some would term it, the liquor sanguinis, preponderates.

But if it should fortunately happen that the patient is rescued from this acute attack, there is a subsequent disease, of a more permanent and equally fatal nature, engendered in the Kidneys of the individual. The delicate reticulated membrane of these organs, which connects the innumerable vessels, oil-tubes, and urinary ducts together, now becomes inflamed and thickened. The pressure on these vessels of excretion, causes, in its turn, a sluggishness and imperfection in the proper discharge of the excrementitious matters of oil and of blood. The individual grows thin, pale, and weak in body. The skin does not perform its healthy functions. The liver is torpid, and the bile formed therein is any thing but natural in colour, consistence, and quality. The urine becomes highly albuminous, the legs puffy towards night; the countenance assumes a haggard and care worn appearance; with these, and a few other tokens of derangement, we may safely affirm that the individual is the subject of permanent obliteration of the oil tubes and urinary ducts of the Kidneys, the first stage towards that intractable, and, I may add, hitherto incurable disease, a granular or mottled state of the vascular portion of the Kidney.

These conditions I shall now proceed to notice, in a pathological, as well as in a medical point of view.

CHAPTER IX.

DISEASES OF THE KIDNEY, &c.

It was the opinion of Dr. Wollaston and Sir H. Davy, that the wonderful phenomena observed in the physical changes of the urine, were to be ascribed to an electrical power, but which process is better understood by the term "vital action." That electricity is one grand agent in nature's operations, for the purposes of combining and decomposing materials in the three kingdoms, no one can doubt; but there is certainly no reason for calling that process, which is known to result from a vital principle in the organ, an electrical operation; yet did the late Mr. Abernethy contend for the same explanation as that given by the other two eminent men. In allusion to Sir H. Davy's interesting experiment at the Royal Society, wherein potash was made to pass through sulphuric acid, by means of two wires from a Galvanic battery, and come out on the other side of the vessel without suffering injury from the acid, Mr. Abernethy was in the habit of addressing his pupils this:—"It is as wonderful as if I were to place a barrel of gunpowder before you, and presenting you with some hot embers, you were to throw them into the powder, and they were to come through it without igniting it. Then I do not doubt but that the action within the Kidney is electrical, though under the influence of the nervous system, and all the functions of the body are governed by that system. It is exceedingly curious how the albumen and matters NOT soluble, are to be converted into that which IS SOLUBLE; and it is very likely that nature has given the Kidney this power of converting insoluble matter into that which is soluble. But here are other difficulties to combat: How is all the old earth and lime to get out of the circulation? How is that animal matter in the blood, which we take in, to get out of the blood? This is done in a curious manner too; nature has given to the Kidney the power of making phosphoric acid, and the Kidney has the power of forming much

more phosphoric acid than is necessary to dissolve all the lime that is secreted for a considerable time. So are salts suspended and albumen held in solution in the urine, and, if perspiration is suppressed, the blood becomes redundant with water, and in that case the Kidney takes up the secretion [1]."

It must be acknowledged, that if there arises the slightest impermeability of the ducts, blood-vessels, or oil-tubes, within the Kidney, that the source and spring of life, the blood, becomes deteriorated, undrained, and impure. This morbid change cannot but materially affect the system, and derange the vital as well as the glandular organs of the whole economy. Lime, with its phosphates, is pent up, and either deposits its various and ever-varying concretions around joints, or, what is more frightful, forms its matrix, or bed, for the procreation of a renal calculus, one of the most painful and distressing diseases to which fallen man is liable.

It has been already shown, that one of the immediate effects of disease and disorder within the Kidney, is a cessation or derangement of the saline exhalations from the skin; and as in the eruptive diseases, to which this investment of the body is liable, the healthy sweat is, for the most part, carried off by the urinary drain [2]; so also, on the other hand, when the Kidney, in consequence of its obliterated ducts and oil-tubes, is unable to help

[1] Abernethy's Lectures.

The explanation here given by this eminent physiologist appears very plausible and clever, but it unfortunately happens, that the true anatomy of the Kidney has never yet been known, and consequently its physiological actions have been equally obscure in the minds of our eminent medical professors. The difficulty here alluded to, of the non-solubility of albumen, and its solubility, through the vital action of the Kidney, is simple enough; this animal substance is derived from oil, and not from blood, within the Kidney, and it flows into this organ in a state of solution, and so passes out into its ordinary drain, the urine. In answer to the two queries above, I would ask, how do the lime and earthy matters get into the blood, and what is that animal matter but organized oil, if such a term may be allowed; that is to say, oil which is no longer isolated, as within the cells of the adipose membrane, but oil in an intimate and vital state of union with the other component parts of blood?

I have elsewhere shown, that lime, with its various phosphates, is exclusively derived from animal oil, and from no other source.

[2] Hence it constantly happens, that the specific gravity of the urine of those patients who are afflicted with leprosy, general psoriasis, or impetigo, presents a very high standard. I have witnessed cases of children, whose bodies were covered with a scaly fretting eruption, and in whom the urine has ranged from 1,028, to 1,030, in weight, whilst this unhealthy standard has gone back to a natural average, when the skin has taken on its healthy functions.

forward any disturbed action of the skin, the system soon yields to the combined forces of deranged secretions, urea, uric acid, and deficient fibrine, circulate in the blood, dropsy and coma supervene, diminished and morbid bile flows from the liver, and the patient lingers, droops, and dies.

Crystals of spermaceti-like substance, the stearine of oil, and minute saline particles or spiculæ, are now formed in the oil-tubes and in the urinary ducts of the Kidney. The peculiar shape of the crystal prevents its further descent into the ducts, and from thence into the ureter. It sticks and wedges itself into the delicate passage, and thus forms a barrier to the further egress of urine along its surface. Hence the spots where the oil tubes and urinary ducts adjoin are, for the most part, so many points of disease. Inflammation, suppuration, and minute abscesses are, therefore, most commonly found in the circumference of the cones, and in that portion of the vascular part of the gland where these adjunctions take place, that is to say, the vascular substance around and between the cones.

It may be here remarked, that modern chemistry has thrown great doubts upon the identity of the composition of sensible and insensible perspiration. There are some eminent men who assert that there is an appreciable difference in these two fluids, and certain it is that the oily, greasy secretion from the forehead and face of a person in a warm room varies in character from the big drops of sweat from the brow of a reaper in harvest time.

It would seem from observations made as to the cause of diseases, that there is something in the profuse perspiration of the whole body which is more inimical to the general mass of the blood, than that insensible exhalation from the skin which is ceaselessly going on during the enjoyment of health. We do not find, moreover, that any serious results follow the use of cold bathing, or of cold shower baths, provided the body is of a due temperature at the time, but we constantly meet with individuals who trace all their dropsical, cutaneous, or renal diseases to a sudden check given to the skin when it was freely perspiring. The whole surface of the bronchial membrane may, in like manner, become inflamed from a sudden change of air, as from a dry and clear atmosphere, to one that is charged with dew and moisture, or with fine particles of dust, or flue, &c.

Cleanliness of person, but more particularly of those parts that are clothed, is rarely to be found amongst the lower classes, at least among the bulk of those who present themselves for

admission into the metropolitan hospitals. This remark especially applies to the poor Irish labourers, and I think that it may be asserted that diseases of the skin, of the Kidneys, and dropsy, are more frequent among this class of persons than among any others, if we except the ravaging scourge of consumption.

The skin among such persons may not exhale differently from other individuals, but that it inhales vapours of a most noxious character must be obvious to any one who has superintended or watched the process of stripping off the clothing of hospital patients. The shirt and flannel (this useless garment being always next the skin) are commonly so offensive to sight and smell, that it creates astonishment in the minds of many how they can endure such a fœtor, and how they can be in health whilst living in contact with garments saturated with acrid, pungent, ammoniacal vapours. And yet so pertinaciously will they cling to their rags of dirt and vermin, that nothing short of a firm prohibition to permit such clothing to be upon them suffices to rid them of it. Nay more, oftentimes have they quitted the institution rather than submit to be cleansed in their skin, or throw off their filthy garments before getting into clean sheets. And the instances are without number, where poor, miserable, half-starved mechanics and labourers have presented themselves for admission, labouring under a sharp attack of fever, or bronchitis, and they have immediately been stripped, well washed in a warm bath, put into a warm and clean bed, their heads have been shaved, a brisk purgative administered, and with good nursing, these plans have been the means, in God's hands, of restoring them to perfect health and vigour without the aid of medicine. Can it be doubted, then, that cleanliness of person is a blessed means of preserving health, and vice versâ? If any of my readers are sceptical upon the point, let him only take a layer of cuticle from a clean skin, and one from such as here described, and submit them to an ordinary magnifying glass, he will find the countless little gaping mouths, or pores, standing foremost in the one, but in the other smeared or plastered over with a thick layer of something like mud [1].

[1] As it is in the natural life, so it is in the spiritual life. The depravity of man's heart, and the utter alienation of his mind from a holy God is so deep and rooted, that he hugs his fancied goodness of heart, his works of merit, deeds of self-denial, and that too with such self-complacency, that though he be told they are filthy rags of self-righteousness, utterly incapable of clothing him when his soul takes its flight from the casket and cradle wherein it now rests for time, and has to stand the all-searching eye of a faithful God in eternity, though it be written out in the unerring

But to return to the curious subject of crystals of oil within the Kidney. The suet of the body is either rancid, or too fluid, or too thick. Now the property which animal oil possesses of crystallizing and assuming a specific shape when reduced to a solid form, as already treated of, fully explains some of those serious evils which result from a sudden check to the copious drain from the whole skin. To quote the important words of Hunter once more: "If we could discover the exact form of the different crystals of oil, we should then be able to ascertain both the different sorts of vegetable oils, expressed and essential; and the different sorts of animal oils, much better than by any other means, in the same manner as we know salts by the forms in which they shoot." I find but a few pathological writers who have noticed the curious spermaceti-like flakes which are frequently found in acute abscesses of albuminous Kidneys; and the cases related by Dr. Christison are so very much to the present subject, that I shall notice some striking features among them. This gentleman took the urine of several patients who presented unequivocal signs of that change of structure in the

truth of Holy Writ, yet he persists in hugging his sins, loves his strange apparel, and will not humble his proud heart, and cast himself, body, soul, and spirit, at the foot of the cross of JEHOVAH JESUS, and seek His spotless robe of righteousness by faith in His blessed name and sacrifice. What infatuation! What awful deceit lies hid in the mystery of the iniquity of the human heart! Sin made our first parents fly from the presence of their offended GOD and CREATOR. Sin showed them their nakedness, and sin made them hide themselves from His face: and if we are found naked in that great and terrible day, having only our own filthy rags of righteousness, and not the righteousness which is by faith in CHRIST JESUS, we shall have to cry to the rocks to fall on us, and to the mountains to cover us. Self-condemned, self-accused, will every unconverted, ungodly, and, therefore, Christless sinner be found, as saith the Scripture, "Hold thy peace at the presence of the LORD GOD; for the day of the LORD is at hand: for the LORD hath prepared a sacrifice, He hath bid his guests. And it shall come to pass in the day of the LORD's sacrifice," oh! hear these solemn truths, ye careless, thoughtless, prayerless souls, "that I will punish the princes, and the king's children, and all such as are clothed with strange apparel." Zeph. i. But the LORD declares, moreover, that this strange apparel is, nevertheless, no covering at all, either for time or for eternity. Its uncommon nature and strangeness is, nevertheless, too current amongst, and common to, professors in these easy days, but when the LORD cometh with ten thousand of his saints to execute judgment, it will be declared that man would not take His simple testimony and proffer of grace. "I counsel thee to buy of me gold tried in the fire, that thou mayest be rich, though thou sayest, already I am rich and increased with goods, and have need of nothing; and white raiment, that thou mayest be clothed, and that the shame of thy nakedness do not appear, though thou art still ignorant and obstinate, and wilt not learn that thou art wretched, miserable, poor, blind, and naked." Rev. iii.

Kidney denominated the albuminous or Bright's Kidney[1], which disease is liable to run on to the termination of abscesses, shortly to be noticed. The expression, "granular degeneration" of this organ, a term lately applied by Dr. Christison to the change now under consideration, gives an imperfect notion of this disease; for it often happens that the whole series of oil-tubes is more or less obliterated by concretions of oil within them, and yet is the organ smooth, and without the least appearance of a granulated structure. The rough or scabrous surface of a granular Kidney is an advanced state of disease, and is only seen when the Malpighian bodies are involved in the general derangement of this organ. These little cryptæ then become hypertrophied, indurated, and white, giving to the organ the appearance of fine sand, or of mustard seeds sprinkled over it. The terminal arteries of the Kidney are never capable of being injected when the disease has advanced thus far in progress. But the first change in such Kidneys is a total or partial impermeability of the oil-tubes from inspissated oil just as they adjoin the urinary ducts, the consequence of which is, that these latter portions become inflamed on their surfaces, from an absence of the lubricating fluid drain from oil. Blood as well as urine flows from them: the surface of the Kidney, where these ducts take their origin, is mottled with dark red or black spots, the result of extravasation of venous blood from the vessels of the reticulated membrane around the venous circles of the gland. This extravasation may be so severe, in the early stages of the disease, that congestion of the blood-vessels within the Malpighian bodies ensues, and these rounded pellets are also found with a sanguineous purple tint.

Now under these changes within the Kidney, it by no means follows as a rule that dropsy should be an accompanying symptom of the disease, nay, I am convinced, from repeated observations, that at least in one half of the number of fatal cases of the albu-

	OZ.	SP. GR.	SOLID CONTENTS.
[1] Albuminous urine passed daily	130	1 011	29 per 1000, of which 20 was urea.
Another case	110	1 013	
Healthy urine	35	1·029	69 per 1000, of which 55 was urea.

The blood drawn in the above, as in other similar cases, was highly buffed, and of the spec. grav. of 1·019. That taken from the infer. cava after death, and treated with nitric acid, produced evident scales of nitrate of urea.—Edinb. Med. and Surg. Journ., 1829.

minous or Bright's Kidney, there has not been, nor is there usually, any sign whatever of dropsy in the body.

The diseased condition of the Kidney is not to be traced out in the various features which a case of anasarca may offer. The presence or absence of albumen in the urine, the alternating heats and chills of the patient, and the strong hard pulse of such cases, are so many symptoms that have been unnecessarily dwelt upon, and unfortunately too much relied on by the modern practitioner and pathologist; the consequence has been, that where these evidences are not well marked, or have been in the wane, other striking and far more important features of the diseased Kidney have been lighted up in the system, but which symptoms have received little or no attention and consideration from the medical man, and the patient has sunk quite suddenly and unexpectedly. I shall now proceed to notice some of these most interesting features in the progress of the symptoms of the albuminous Kidney.

CHAPTER X.

DISEASES OF THE KIDNEY, &c.

It has been already remarked, that dropsical effusion into the tissues or cavities of the body is not to be considered an essential feature in this disease of the oil tubes and urinary ducts. The reason wherefore the blood drawn from a vein buffs and cups to a greater extent, perhaps, than in acute rheumatism even, is the following. The two component parts of oil, its elaine and its stearine, pass into the circulation undeprived of its watery and sizy portions. The urine is not separated so much from oil as from venous blood, hence the specific gravity of this fluid soon presents a very low standard, and is fixed to a range of one or two degrees, instead of six or eight, as is the case in health, for the drain from oil gives the chief specific weight to the urine.

During the progress of this disease, a large quantity of urea

and uric acid accumulates in the system. If the Kidneys cannot drain the body of this product of animal oil, it must necessarily become pent up in the general mass of circulating oil and blood [1]. The presence of this animalized substance in the blood is highly injurious, and most commonly destructive of life in a few days. The first evidences of its circulation are dizziness in the head, a sensation across the forehead, as though a tight cord was bound round the temples, which is commonly called a headache by the patient, though it differs somewhat from it; dimness of, and sometimes duplex, vision. These cerebral disturbances are aggravated towards evening, so that the individual passes sleepless and restless nights; they will also occur in paroxysms with a lancinating or throbbing sensation, which gives the patient a feeling of approaching derangement of mind.

These symptoms are oftentimes so gradual and so insidious that the medical man is quite misled as to their character. He attacks the stomach, the head, and the liver, but does not suspect the Kidneys to be in fault throughout the complaint. It however happens that a sudden fit of epilepsy, or of insensibility and coma, supervene, and then the cerebral symptoms are considered as certain tokens of morbid changes within the brain.

Many instances have occurred in which individuals have been brought into the large institutions of this metropolis in a state of coma, and who have been attacked with a sudden and unexpected fit in the street, and yet, on examination of the patient in bed, it has proved to be a case of slight dropsy, with albuminous urine. The history of all such cases has usually been identical, that they had suffered from lumbago, and "flying pains" in their limbs, headache, and slight deficiency of memory, and that latterly the legs and ankles became puffy towards night, till at length the headache and dizziness had increased, and they had lost all consciousness in a paroxysm of epilepsy.

Now the urine, under these dropsical effusions, with urea circulating in the blood, does not necessarily diminish in quantity, nay more, the dropsy may gain ground day after day, and yet the urine increases in quantity, but will certainly diminish in its specific weight. Here is another source of perplexity to the practitioner; he is too much swayed in his hopes of the case, and

[1] The animal alkali, ammonia, in its elementary compounds, enters largely into the composition of urea, for if urea is distilled, it yields two-thirds of its weight of ammonia, and if potash be triturated with urea, the disengagement of ammonia is very great.

in his treatment of the dropsy, by the quantity of urine daily secreted, so that "the relative scantiness of this secretion is not at all an accurate measure of the relative urgency of the disease, and vice versâ [1]."

Whenever these changes in the Kidney advance slowly towards a fatal termination, the renal arteries become obliterated in their large trunks, as well as in their minute contortions within the Malpighian bodies, so that in some instances I have had some difficulty to find the first divisions of this vessel. This advanced condition of disease soon engenders the abscesses within the gland, alluded to in the preceding chapter. The fat around the Kidneys is now converted into a hard, indurated, or nodular mass, there is a peculiar substance formed in the vascular part of the glands, which is neither albumen, nor gelatine, but possessing a character sui generis. It is somewhat analogous to the waxy, cheesy, or glue-like deposits around scrophulous joints, or within the arteries of confirmed drunkards. The various degrees to which these deposits advance are characteristic of the respective stages of structural disease of the whole organ. These cheesy or gelatinous depositions increase in size, and, like the tuberculous masses in the lungs, become aggravated, and form one large abscess or vomica. The contents of these abscesses present a brain-like mass, surrounded by a less solid substance, and an opaque or milky fluid. By a careful inspection of this fluid, we may observe a quantity of crystallized spermaceti-like flakes floating in it; the true crystals of oil, as I deem them. These flakes have been examined with much care by Dr. Christison, when he found them to consist of white, brilliant, and silvery scales, soluble in alcohol, from which they crystallized on cooling, insoluble in a solution of caustic potash, and fusible at a temperature somewhat higher than 212°.

In the cases related by this talented physician, the infundibula were lined with the same kind of flakes, and the serum of the blood presented very commonly a slight milkiness which resulted from the presence of "a little oil" in this fluid [2]. He detected

[1] Dr. Christison, Edin. Med. and Surg. Journ., 1829.

[2] It was, in other words, oil in the serum that had not undergone the vital process of draining and purification by the oil drainers, the Kidneys, and so passed into the blood as impure animal fat; for if the spermaceti-like principle in animal fat is largely diluted with oil, as is the case in the whale tribe, it is dissolved or melted by a much smaller degree of heat than when alone. Now I have before remarked, that the blood in this disease is below the average standard, and, therefore, one would infer that this animal suet was not duly melted or dissolved in the serum.

this animal substance by agitating the fluid in a glass tube with ether, allowing the mixture to be at rest for a few seconds, and withdrawing and evaporating the ethereal fluid [1].

Whenever the circulation of urea has been the immediate cause of death, the disposition of the solids and fluids of the body to run into a state of rapid decomposition is quite remarkable, insomuch, that a whole ward has been filled with an insufferable fœtor at the instant of dissolution, and the corpse has presented in a few hours the appearance of an advanced stage of putrefaction. In those instances where dropsy has supervened before death, the whole cellular tissue of the body is found to be soaked with water, the fat in its cells is pale and flabby. The pericardium is either covered with recent layers of shreddy lymph, or else it is tinged with blood. The renal fat is wholly removed, or if any remain it has a nodular feel and an unhealthy aspect. The reflected membrane of the Kidney tears off with some difficulty, and brings with it more or less of the reticulated membrane, and the fleshy origins of the urinary ducts.

The vascular surface is mottled, and corresponds to the description given by Dr. Bright, whose words cannot be improved upon by any further addition on my part; I shall, therefore, quote them at length. "The whole cortical part is converted into a granulated texture, where there appears to be a copious morbid interstitial deposit of an opaque white substance [2]. In its earliest stages this only produces externally an increase of the natural mottled appearance, or sometimes that of fine sand, sprinkled more abundantly on some parts than on others. The same appearance is observable internally on making a longitudinal section. After the disease has continued some time, the deposited matter becomes more abundant, and innumerable specks of no definite form are observed on its surface. The cortical part, on being cut into, exhibits a similar appearance. Later in the disease, the granulated state begins to show itself externally in frequent slight uneven projections on its surface, and the Kidney is rather larger than natural [3]."

This eminent physician proceeds to notice another striking feature in the diseased structure of albuminous Kidneys, and one in which, I believe, the animal oil has become too liquid and

[1] Med. and Surg. Journ., 1829.

[2] This white matter is the suety portions of animal oil (stearine), which is seen sticking in the oil tubes and urinary ducts.

[3] Dr. Bright's Medical Reports.

thin, and, consequently, unfitted to sustain and invigorate life and health. "There is a preternatural softness in the organ, and this change is accompanied with a corresponding loss of firmness in the heart, liver, and spleen, and in such instances the urine is sometimes coagulable." I should be inclined to view this condition of the Kidney as another stage of the same disease. The organ ceases to drain away all the constituents of water from oil, but separates a fluid from venous blood; the oil-tubes are either empty, and lie waste, or are filled with a thin, aqueous, and too fluid oil. This gives to the body of the organ a flabby and soft consistence, and the Malpighian bodies are of a dirty white appearance, become hypertrophied, press upon the surrounding tubes and ducts, and render the whole organ, in process of time, a mass of greasy, unctuous, and whitish matter, with a faint ground of a vascular structure beneath or around it.

With respect to the softened state of the heart now referred to by Dr. Bright, I must here make a few remarks. It is evident that this gentleman does not allude to any such change in the heart as that from idiopathic carditis grafted upon rheumatism, or from a malposition of this organ from pleurisy, or from an adherent pericardium; these diseases are not the ordinary causes of a softened and flabby heart, but the reverse. The latter is the effect of one cause, and of one only; a diseased and impervious state of the whole series of oil-tubes of the Kidney, constituting the albuminous, or Bright's Kidney. Co-existent with this softened condition of the walls of the heart, there is a thinning of its muscular substance, and, consequently, a dilatation of the several cavities of this organ. The indications of these changes are to be detected by auscultation; thus the impulse at the mamma is feeble, the sound is a dull, prolonged, and distant murmur. I say sound, for it is rare that the diastolic or second sound of the heart, under such a change, can be termed a sound at all, it is so feeble that it is scarcely audible, or it is so much thrown into the first or systolic sound, that one continuous murmur can only be detected by the ear. In this state of heart, where the healthy correspondence, in space and power, of the auricles and ventricles is lost, the jugulars are distended, and pulsate from regurgitation of the fluid contents of the right auricle and ventricle, and are seen to swell out into a varicose fulness at each fit of coughing, or during a deep inspiration. There is more extensive dulness on percussion over the præcordial region than in the healthy state of this organ.

It unfortunately happens that some eminent stethoscopists of the present day have followed the great founder of auscultation, Laennec, too closely in his opinions upon the various diseases of the chest, and they have copied some of his errors, whilst they have carried out, in a more complete form, his valuable remarks and discoveries. One great error into which this eminent man fell was concerning the cardiac sounds, and the mode by which they were produced. This error, like all other errors, when it is made at the onset, leads on to unsound reasonings and false conclusions, so that his treatise on diseases of the heart falls very short of the other portion of his excellent work wherein he describes the diseases of the lungs, pleura, &c.

There are a few authors of our own day, who, like Laennec, assert that simple dilatation of the cavities of the heart is attended with an increase of sound. This cannot be correct, for a dilated heart is a weak and attenuated heart, and such an organ is unable to give a forcible and vigorous grasp upon its contents, the blood, and consequently can neither produce a louder sound, or a stronger impulse, than a healthy heart.

It is, moreover, an important symptom in the treatment of this form of dropsy, or of diseased Kidney. It denotes a debility of the whole system, as well as a deficiency of fibrine and solid matters in the blood. In proof of which, these cases ordinarily improve in a wonderful and rapid manner, under the very same treatment that the physician would adopt in amenorrhœa and chlorosis, &c. Steel, bark, and wine, with a generous diet of meat, porter, eggs, jellies, and strong animal broths, are the appropriate remedies under each of the above changes in the animal economy; and I feel assured, that if the practitioner attended as much to the due exhibition of these nourishing and tonic remedies in the renal disease now under consideration, as he does in the female disorders alluded to, he would have the gratification and pleasure of witnessing a very different result in his patient's progress towards convalescence.

CHAPTER XI.

DISEASES OF THE KIDNEY, &c.

The frequent occurrence of epilepsy, head-ache, coma, somnolency, and even of hemiplegia, and partial idiotcy, in connexion with renal disease, has been already hinted at in the foregoing pages. But the serious forms of the above diseases most commonly present themselves when the Kidneys have been suddenly arrested in their healthy actions.

Aretæus was practically acquainted with these facts. This author remarks, that " Sometimes there bursts from the Kidney a copious flow of blood, which continues many days; no one, however, dies from this symptom, but from the inflammation which accompanies it; if the blood should happen to be suppressed, death generally follows from the suppression, and subsequent great inflammation. Again, after this discharge of blood, the patient's limbs become languid and relaxed, but the head lighter, and more unencumbered. But if no urine flows out from the blood's circulation, the head aches, the eyes become deadened and dim, and roll round and round; then some are attacked with epilepsy, others become swollen, dizzy, and dropsical; others lapse into melancholy or paralysis. In many instances gout has passed into dropsy, in others into asthma; and from this succession of diseases death cannot but follow shortly [1]."

There are some modifications of the disease I am now considering, in which hypertrophy of the renal fat has created so much impediment to the equal flow of oil through the tubes, that their internal surfaces are blocked up with white, chalky, or gritty substances, having the appearance of innumerable calculi, or crystals of oil. The whole organ is ordinarily embedded in a large mass of indurated fat, and the change is usually confined to one Kidney; for it rarely happens that both organs present

[1] Vide Appendix, No. 26.

the same stages of this disease. Hœmaturia, head-ache, stupor, subsultus, and coma, have been the prominent symptoms of this change of Kidney. The skin presents a dirty or dingy hue, dry and harsh, without hair. The countenance distressed, cough, asthmatic breathing, palpitations, and internal effusions, have been lighted up before dissolution took place.

The further description of the symptoms of renal diseases, by this eminent man, are surprisingly correct and trite.

The chronic form of rheumatism, without swelling, or redness of joints, is often observed to accompany this diseased change in the Kidney, and the obstinate nature of the attack has been too often attributed to the disease, rather than to the misapplied, and consequently inefficient, potions employed for its relief. A diminished quantity of lubricating joint oils is the immediate cause of these pains, and a disordered action of the circulating glandular oils of the Kidney, &c. is the proximate cause.

In connexion with the flabby state of the muscular walls of the heart, and the granular or albuminous Kidney, there arises most frequently an asthmatic cough. Emphysema of the lungs is a cause of the latter symptom, and when once it is established in the pulmonary tissue, there is a proneness in it to advance, until the greater part of the organ is emphysematous. Large crepitation now sets in, and is heard over the lower tubes behind. Frothy mucus, or a gum-like expectoration, follows. The patient requires to have his head in a more elevated posture during the night, his face and lips become turgid, his extremities livid and cold, and death shortly carries him off.

The description given above of the preternatural softness of the heart, applies also to the liver. The lobular vessels of this gland, from which the bile is immediately separated, are filled with thin watery oil, or blood deficient in omental and intestinal oil, the necessary ingredients for enabling portal blood to secrete bile. From several observations made upon the state of the liver in those patients who have died from albuminous Kidneys, I believe that this gland will be found to present a state of portal, more frequently than of hepatic congestion.

The mucous membrane of the stomach and intestines partakes of this softness. It is oftentimes so pulpy and exsanguine, that it can be separated off by the finger or nail, and sometimes it is puckered here and there throughout its course by the formation of blebs of water beneath its surface. As this membrane is endowed with glands throughout its whole course, which send forth

an oily and lubricating fluid, to mingle with the food, and to aid in the formation of chyme, chyle, or feculent matters, according to the respective portions of the intestinal canal, it therefore follows that these bodies must suffer, and become involved in the general disease of the circulating oils.

Another pathological feature in the renal disease now under consideration, is the extreme redness, or, as some would strive to persuade us, the stain of the inner surfaces of the blood vessels of the body, post mortem. This appearance will run up as far as the cavities of the heart, so that the right side of this viscus has presented a deep modena red colour, whilst the left cavities were tinged with a scarlet hue. Not that this curious phenomenon is confined to this or that form of dropsy, for although it is rarely met with in other fatal diseases, yet it is by no means an invariable feature in this morbid change of the Kidney. "The late Mr. Freer believed that inflammation of the lining membrane of the blood-vessels was common in dropsy, and we have seldom opened the body of a person dying with general dropsy which did not exhibit some disease of this membrane[1]." The truth is, that the change arises from an altered state of the fluid circulating in the vessels; some chemical change in the quality of the blood is the source of this universal stain. In fatal cases of delirium tremens, influenza, and the malignant spotted fever of 1836 and 1837, it has been noticed, and in such subjects the blood has never been found perfectly coagulated in the cavities of the heart after death. This fact has led many pathologists to question whether the appearance did not arise from a stain communicated by the fluid blood. This explanation, however, is quite groundless, when we reflect that the whole areæ of the vessels, both arterial and venous, down to the extremities, have been equally tinged, which could not be the case if their contents stained them; for blood is not found in the smaller vessels after death, and where it is seen, it only occupies the lower surface of the tubes. Again, there are innumerable instances in which this appearance never presents itself, as for instance, in those who die from apoplexy, fractured skull or spine, or from a suicidal death. Moreover, I have carefully dissected the greater part of the arterial and venous system of the Kidneys of those who have died with this tinge upon the surfaces of the vascular system generally, and there has been a continuous red or pur-

[1] Cyclopedia of Practical Medicine. Dropsy.

plish colour along the blood-vessels, even to the minutest twig. Specimens of such changes are easily dried and preserved, and the dye on the surface remains for many months, or even years, unfaded in colour.

I must now proceed to make a few concluding remarks upon the third division of diseased animal oils, in which change this fluid, I conceive, becomes decomposed in its chemical properties. If a portion of fat is mixed with a hot solution of potash, the constituents react on each other, and the solid margarine and a fluid oil are the products on the one hand, whilst there remains a substance presenting all the characters of saccharine matter. This sugar, or "sweet principle," remains free; but the other two substances are in a state of saline combination with the caustic alkali employed. The processes, which are here described as the results of the experimental chemist, are strictly analogous to the vital, yet morbid actions, which go on within the Kidney and its oils, in those individuals who are afflicted with diabetes. In this disease the animal oil around and within the Kidney is the seat of a constant decomposition. In what manner, or through what means, the predominating alkali is first introduced into this substance, I am at a loss to ascertain, and, considering the careless manner in which the chemical properties of animal oil have been hitherto passed over by modern writers, it ought not to be a matter of surprise that so little light has been thrown upon this intractable and fatal disease. In those instances where I have had an opportunity of witnessing the post mortem examination of diabetic persons, the renal fat has disappeared, the Kidneys were very vascular, and rather flabby, but the oil-tubes were pervious, and, as I imagine, the constituents of animal fat were drained off, without undergoing that vital and peculiar sifting, or purification, which it is the especial function of the Kidney to perform.

In purpura, erythema nodosum, and scurvy, the animal oils are rancid, or too fluid or too thick; and, from the fact that mineral or vegetable acids are highly beneficial in these forms of disease, I apprehend that there is some peculiar alkalescent predominance in the oil and in the blood. But in diabetes, there is, however, an additional change effected by this altered state of the oils. The sweet or saccharine urine is the result of a decomposition of oil within the Kidney; indeed, not in this organ only, but throughout the whole body, for other secretions partake of this saccharine character, as the saliva and sweat. Every kind of food that a diabetic patient receives into his mouth, has a sweetish

taste with it while it is on his tongue. Whilst the saccharine matter of oil is set free, this animal substance is unfitted to sustain life, and nourish the body; it must be, consequently, a very important principle in the oil. But the change here alluded to is not confined to diabetes, for similar operations go in the human oils when the body is labouring under other diseases. The sweet sputa and saliva of phthisical patients, the saccharine property of milk, the honied taste, according to Hunter, of pus, may be noticed here. Hippocrates has remarked, that the sweet smell and taste of cerumen is a fatal symptom. An eminent physician of our own day mentions, that a melleous breath in dropsy is an unfavourable symptom. Numerous instances that have come under my own observation confirm this last statement.

In order to give the preceding remarks upon diseases of the Kidney some concise form, I shall here subjoin a rough tabular view of the diseases of this organ, that it may form a nucleus for subsequent observations and researches, by other members of the profession.

Diseases of the Animal Oils.

1. Superabundance of circulating animal oil.	1. Excess of oil in the oil-cells of the adipose tissue.—Brawny dropsy, obesity, porrigo, lichen, lepra, &c. &c. 2. Excess of oil in the blood.—Acute rheumatism.
2. Diminution of circulating animal oil.	1. Deficiency of oil in the oil-cells of the adipose tissue.—Doughy dropsy, crystals of oil in the Kidneys, &c. 2. Deficiency of circulating glandular oils creating a derangement in the lubricating joint oils.—Chronic rheumatism, gout, arthritic concretions, locked joints, struma, sciatica, and scrofulous diseases of joints and their coverings.
3. Decomposition of circulating animal oil.	1. Obliterated oil tubes in the Kidney, from crystallized oil, with subsequent impervious blood-vessels.—The albuminous, granular, or Bright's Kidney. 2. Concretions of oil in lumps, or cysts of waxy and sebaceous substances.—Epilepsy, hemiplegia, coma, convulsions, &c. 3. Acridity, or an undue alkalescence of the circulating oils, causing a rapid consumption of the animal oil.—Delirium tremens, diabetes, phthisis.

It must be quite apparent, however, to the professional reader, that the subject of diseased animal oils is yet in its infancy. I cannot pretend, in this volume, to offer any thing beyond a few general observations, founded, as they are, upon the numerous cases which have passed under my notice; and, if these materials should be deemed sufficient to form a basis for the prosecution of the subject by any talented member of the profession, my labours

will not have been fruitless, and one desire which has cheered me in writing these pages will be accomplished, that of relieving the sufferings of my fellow-creatures, by instituting a novel inquiry into some of those diseases to which man is liable, during his passage through time into the countless ages of an eternal world.

APPENDIX.

CASE I.

BRAWNY DROPSY.

John Magrath, about 35, Irishman, labourer at Covent Garden Market. Face, chest, and legs swollen to such an extent, that, as he lay in bed, he occupied nearly a square surface. His picture more resembled the famous fat man, Daniel Lambert, than I ever before witnessed. His legs were of a boardy hardness, mottled, with blebs, and dark meandering veins, and approaching in appearance and feel to the disease called elephantiasis. He was much swollen in the abdomen, but no fluctuation could be detected. His breathing, in the earlier stages, was not much distressed, nor did he require a high posture for his head; but he lay for some weeks in the recumbent position. His urine was clear, pale, slightly albuminous on heating it, and of the sp. gr. of 1·010, ranging constantly between this number to 8 and 12; but never above 12, though it was frequently as low as 8, and rarely rose to 12. Auscultation afforded no evidence of disease of the heart and lungs, beyond emphysema, in the lower lobes of the latter organ. His appetite was bad, and he owned to having been a spirit drinker. He never had had acute rheumatism, though he had been laid up with rheumatic pains, without swelling, in some of his joints. He never before had had dropsy.

His present attack commenced a few weeks before, and was dated from his getting wet through in the market, and standing amongst the wet filth of the refuse vegetables. His legs first swelled, and then the thighs, and latterly the chest and face, &c. He stated that his urine had been very thick and high coloured, but had lately become quite clear and pale.

This poor fellow continued to get worse, and increased to such an incredible size, that I regret the dimensions of his body were not taken down, or a drawing made of his extraordinary appearance, as I am persuaded it was the most aggravated form of this disease. The peculiar brawny hardness remained until within a week or so of his death, when the vessels in the toes, and ankles, and hands, relieved themselves of much watery fluid, and their surfaces freely pitted on pressure; with this exception, no dent could be made, throughout the progress of the case, by the finger on the skin; and this covering of the body was as tense and hard as a pig's back.

He lingered on some months, and at length sunk from bronchitis and hydrothorax. His friends would not permit a post-mortem examination.

I may mention here, that in a case of a young woman, 18 years of age, afflicted with this disease, and which proved fatal, in the year 1833, the thighs measured thirty-three inches in girth, and were equally as hard and brawn-like as this poor fellow's. She was such a spectacle, that many medical gentlemen visited her, and were astonished at the features of the case.

These are instances where a superabundance of oil in the blood and in the oil-cells give rise to the form of dropsy here described. Bleeding, and cupping to the Kidneys, and active purging, are by far the most useful remedies yet employed.

CASE II.

DOUGHY DROPSY, FROM DEFICIENCY OF ANIMAL OIL.

Sarah Moore, 28, single. Countenance pallid and sunken, skin of a dirty fawn colour, hands and feet mottled, and slightly swollen; a few spots, like psora, over the calves and thighs; œdema of the lower extremities. The hair entirely removed from them. Deep pitting of the swellings on pressure. Lips pale, voice hoarse, slight dry cough. Abdomen flaccid, though somewhat swollen, no fluctuation. Dilatation, but no pulsation of the jugulars. Some palpitation. Catamenia absent two months, and scanty several months previous to their cessation. Owns to no special pain. Lies flat. Urine pale, clear, no sediment, no albumen, acid, and of Sp. Gr. of 1·010.

Auscultation.—Heart's action feebler than natural, both in sound and impulse, especially the former. Respiration feeble in some parts,

but clear in other portions, especially in the upper lobes. Percussion good all over.

The attack commenced three months ago, with slight swelling of the ankles, on a diminution of the catamenia. Never had rheumatic fever.

During the progress of the disease, her urine became so free from all stimulating salts, that the bladder was not called upon to expel it, and the catheter was necessarily used. On the 19th of November she was suddenly seized with acute pain beneath the left mamma, and œgophony was distinctly heard behind, and dulness on percussion was observed on the same spot towards evening. For this attack she lost 8 oz. of blood, which was allowed to flow over the bulb of a very delicate thermometer, the thread of which was standing at 98°, but, during the whole process of bleeding, the current of blood sent it down to, and kept the thread at 95°.

On the night of the 21st she took an opiate, and within one hour after it she was attacked with violent convulsions, stupor, and coma, just like an epileptic seizure. These symptoms recurred through the night and following day, when she died in the struggles of the eighteenth fit. No auscultation was made from the 19th to the 22d, on account of her distressed state. Her body, as soon as life had departed, emitted a most suffocating, offensive, sour fœtor, as though it had been advanced in decomposition.

The examination took place forty hours after death.

Head.—The brain bloodless, and free from excess of serum in the ventricles. Healthy in structure.

Thorax.—Pleuræ not adherent. A quantity (perhaps a quart of) fluid on the left side, citron coloured; this lung carnefied, and sodden, from pressure. Slight emphysema of other portions of the lungs. Pericardium contained about half a pint of bloody serum. The surfaces were coated with thick, rough, and firm coagulable lymph, hanging in shreds and festoons. The substance of the heart was the colour of red velvet, from inflammation of its cells. The valves all healthy. The parietes of the left ventricle slightly thickened, the cavity smaller than natural. The reverse on the right side.

Abdomen.—Liver was very large, covering a great part of the stomach. Universally mottled, and in an advanced state of congestion.

The fat of the mesentery, Kidneys, and skin, was of a pale and dirty yellow colour, very soft and flaccid, not diminished around the Kidneys, and a plentiful supply within their bosoms. These glands were one-third smaller than natural. The membrane peeled off with great ease, and exposed their surfaces, mottled with red and white points of elevation, like a raspberry just on the turn of colour before it ripens, when the various points are white, and the little furrows between these round globules or glands are red, and ripe in appearance. When cut open,

the vascular part was very much diminished, and the tubular portion streaked here and there with white lines. Evidently they were oil-tubes, blocked up by concrete oil. In short, the whole system of oil-tubes, within the vascular portion, were obstructed by concretions of stearine, within their areæ.

This form of dropsy is very intractable, though it is so common, yet am I convinced that the proper treatment is rarely adopted; it should consist of tonics from the first, such as steel, bark, generous food, porter and wine, with good milk as an ordinary beverage; allowing the patient to drink two quarts in twenty-four hours, or as much as he pleases. Under such treatment the Kidneys will oftentimes resume their natural action, the circulating animal oils will be richer in quality, their drains from the Kidneys and from the skin will be restored to a healthy character, and the patient be seen to rally in an extraordinary manner.

The sudatorium, or sweating bath, is a valuable remedy also in this sluggish condition of the skin, so constant an attendant on this form of dropsy.

CASE III.

SCARCITY OF OIL FROM THE SAME MORBID CHANGES, TE MINATING FATALLY IN A FEW WEEKS, WITH DROPSY SUPERVENING.

G. C. 60, labourer, when first seen was supposed to labour under retention of urine, as he positively asserted that he had voided but half a pint during the previous six days. A catheter was readily passed, but not more than $3\frac{1}{2}$ oz. of urine flowed, deeply coloured. His looks betrayed some general distress; he was heavy, like a semi-intoxicated person, his eyes sunken, but very rational and collected. Vomiting after every kind of food he takes. P. slow and laboured. T. slightly furred. B. reported regulaı.

He states that he caught cold a week since, having previously enjoyed good health. Had heats, succeeded by rigors, with pain and giddiness of his head, and a total suppression of his urine.

He was put into a warm bath, and had Stevens's saline powders[1].

[1] Each of these consists of:—Chlorate of potash, six grains.
Carbonate of soda, half a drachm.
Muriate of soda, a scruple.

On the 16th he passed a small quantity of dark, thick, bloody urine; his loins were observed œdematous, he was drowsy, and his pulse increased in power and velocity. For these symptoms he was cupped to his loins, but with no relief. On the 18th the legs became anasarcous (doughy), with purpuraceous spots over them; his urine as before. On the 20th, the stupor continuing, and his articulation becoming indistinct, he was bled to 8 oz. whilst under the influence of the saline powders. The blood, as it flowed, was of a bright scarlet colour, exactly resembling arterial blood. He was again cupped to the loins on the 22d, but towards evening he fell into a state of complete coma, with constant tremors of the hands, muscles of the arms, face, and twitching of the zygomatici; wandering; and with difficulty roused. Articulation confused, lies on his back, with his eyes vacantly fixed on the cieling. He bit his tongue in several places. Respiration became more and more distressed, and he died in a semi-convulsive fit on the 24th.

POST MORTEM EXAMINATION.

Abdomen.—Some fluid here. Liver and intestines apparently healthy. Kidneys natural in size, but presenting externally the appearance of mottled or Castile soap, being in some parts studded with bloody spots, but, in general, having the character of an aggregation of minute glands, of an ash colour, with an intermediate vascular substance, highly injected. On making a longitudinal incision of one, the greater part of its tubular portion, the pelvis and infundibula, were found loaded with, and supplanted by a quantity of fat. The urinary ducts were filled with dark blood, so that they presented so many red lines, instead of their natural white and fibrous appearance. The cones were fewer in number than ordinarily. The ureters were pervious. The bladder was much contracted, and its coats thickened. The mucous membrane was studded with dark hœmorrhagic spots, like black currants. The organ was empty. The prostate not enlarged. Urethra quite pervious.

Chest.—The effusion was not great in the pleuræ. Right lung healthy. The left was compressed, sodden, and carnefied, impervious to air. The bronchial membrane congested.

Heart.—On opening the pericardium, the surface of the heart was covered with a semi-organized layer of lymph, the result of recent pericarditis. There was but little fluid in the pericardium. Internal membrane was healthy, the cavities dilated. The blood was universally fluid throughout the body. There was none in the left ventricle, and only one oz. in the right.

The Head.—The brain was healthy, save a slight thickening of the arachnoid.

The peculiar feature in this case will appear, on perusal, to be the

total absence of secretion from the Kidneys during a period of six days prior to his illness, and the trivial symptoms that arose therefrom.

When the saline treatment was in full force, he evidently rallied. It was omitted a few days, on account of an attack of rheumatic swelling of his wrists and ancles, and he again rapidly sank. His urine became more bloody. Convulsive twitchings of the muscles of the face, and impaired deglutition continued three days before he expired.

CASE IV.

DEFICIENT OIL IN THE BLOOD FROM DISEASED KIDNEY. HYPERTROPHY OF THE FAT.

J. E. tailor, 62. Pain in the chest, shortness of breath for the last fortnight only, anasarca of legs, as high as the knees since the 10th ult. Skin white, shining, without hair. Abdomen hard. B. much confined. Evacuations described as very dark. Uneasiness, on taking food, at the stomach ; complains of flatulence, and occasional vomiting, also a sensation of acidity in the throat ; matters vomited usually sour. Pyrosis. These stomach complaints have existed for some years. Has been in the habit, till lately, of drinking large quantities of porter. Rapidly wasting, and constant thirst. Urine neutral.

Auscultation.—Large crepitation over both lower lobes behind. Respiration bronchial about the left scapula. Jugulars dilated. A noisy motion of the heart, without any " bruit."

He states, that about a year ago he was troubled with difficult micturition, and had severe pain in one Kidney, and then passed blood by the urethra : but of this he got well.

On the afternoon of the 22d he had got out of bed to pass water, when he suddenly fell back in a fit of insensibility and moaning. Pulse became intermittent directly. Pupils contracted to a small aperture. Passed his evacuations involuntarily, and died in the course of the following morning.

POST-MORTEM EXAMINATION.

Abdomen.—Liver of a strange uniform drab colour. Small intestines very dark in colour, owing to a tar-like fluid (altered blood) contained in them. Numerous hard scybalæ in the colon. Bladder contained pale urine. No calculus. Right Kidney very large ; on laying it open, various masses of disease, consisting of portions like

brain, and of others consisting chiefly of blood, with some, but few, parts exhibiting the natural structure ; ureter pervious. In the place of the other Kidney a large lump of hardish fat was found, and in the centre of it a very small Kidney, hard, but not manifestly impaired in structure.

Chest.—Lungs of a dark purple colour, here and there, much gorged with blood, emphysematous towards their edges, with a patch or two resembling pulmonary apoplexy ; fluid in pleuræ, pericardium, and peritoneum ; heart large, left ventricle thicker than ordinary ; all the cavities dilated, especially the right auricle ; tricuspid and mitral valves hard and opaque ; some thickening also of the aortic valves, yet not such as to interfere with their play.

I should have placed this case under the head of "decomposition of oils," as the disease in the right Kidney must justly be termed, and which change was most probably the immediate cause of death. It is, however, placed here, to show the character of the disease and its results. When contrasted with the following, it bears a striking resemblance in many of its pathological features. If a calculus had formed in the right Kidney, as in the following case, death, most likely, would have arrived at an earlier period, as the decomposed oil and sebaceous matters within the gland, could not have effected any escape, as they here did.

I am sorry that I delayed getting the outline of the case above alluded to, but it is simply this : sudden death, and a calculus found in one Kidney, which was fatty in its whole texture, and no disease, as far as I recollect, was detected, in other organs.

I might also mention here, that a marked case of slight dropsy, convulsions, coma, and death occurred about this time in a young man who had every appearance of having been a robust and healthy individual. He died in one of the several fits of epilepsy. The Kidneys were imbedded in hard, nodular fat, which passed into their bosoms in such huge lumps or masses, that when laid open, two-thirds of the organ was occupied by this hypertrophied fat. He had also enjoyed excellent health, and was of temperate habits. The whole of the internal organs were carefully examined, but no trace of disease could be found elsewhere.

CASE V.

CONCRETIONS THROUGHOUT THE WHOLE SYSTEM OF FEATHERY OIL-TUBES OF THE KIDNEY.

A. B. aged 53, married, has had 7 or 8 children. Prominent and oscillating eyes ; slightly wandering, as she confesses, in her mind ;

says all her trouble is in her head; has been ill a fortnight. The illness began after some agitation from a domestic quarrel. Is said to sleep ill, and to have been thirsty and feverish. Bowels reported neither relaxed nor costive. T. furred. Has kept her bed, mostly, for a fortnight. Respirations laboured, with a cough. Urine said to be sufficient in quantity; acid and albuminous.

July 11.—Wandered much all night. Skin cool.

July 12.—Lies on her back, moaning incessantly. Is said to have had "two fits of shivering" during the night. T. dark and dry. After the so called "fits of shivering" her hands and face were chilly, with cold perspiration upon them; her mouth and face were also drawn on one side, and she looked, as the nurse expressed it, in "a convulsive struggle." Pupils contracted. P. 100 hard. Urine is of a whitish-yellow colour, just as if some milk had been mixed largely with it; chylous, acid, of spec. grav. 1·012. When questioned, refers all her distress to her head, but cries out piercingly when pressed in either renal region.

July 13.—Had six minims of laudanum every two hours in port wine, last evening, but after the second dose, gradually lost the power of deglutition; lies moaning; does not answer when spoken to; has passed evacuations involuntarily; continued to sink rapidly, and died on the morning of the 14th.

POST-MORTEM EXAMINATION, 12 HOURS.

Thorax.—Both lungs were adherent from old adhesions to the ribs, especially at the lower parts. A small quantity of fluid in each pleura; the lungs universally crepitant, but loaded with frothy serum, and patches of well-marked emphysema were seen in both; pericardium healthy, without any serum; heart natural in size; right side natural; left rather thickened; both the mitral and aortic valves being more rigid than in a healthy subject.

Abdomen.—Parietes loaded with fat, as was also the omentum; intestines distended with flatus, otherwise quite healthy; spleen small and firm; liver appeared healthy also. The Kidneys were so very small, that they might be compared in size to a lamb's kidney; they were extremely blanched; the vascular portion being no longer permeable, and it was degenerated into one-third its usual size; the tubuli were reddish, and rather crimped.

Brain.—Here and there slight strings, of lymph apparently, between the arachnoid and dura mater; slight effusion beneath the former membrane; some fluid in the lateral ventricles.

CASE VI.

DECOMPOSED OR ACRID STATE OF THE CIRCULATING ANIMAL OILS.

B. H., aged 47, cabman; complains of pains in his limbs, and general feeling of illness. T. brown and dry; B. open; evacuations reported dark, watery, and offensive; slight cough, but no expectoration; skin hot, but moist; no difficulty in passing urine; it is slightly acid, dark brownish red, with a deep brown deposit, consisting, apparently, of globules of blood; clouding when heated; breath urinous.

On the 1st of this month got very wet, when he was seized with shivering and pains about his loins. About a week since his urine became, suddenly, thick, and red, as at present; he obtained some medicine for it, which purged him, and he became worse, with subsequent vomiting, and great debility.

There is much reason, however, to suspect that his mind wanders a little, for his memory is evidently clouded, and he looks somewhat bewildered. He stated to others that he was drunk when exposed to the wet, and had been so frequently of late. Pulse is irregular in force and in frequency. He was ordered to be cupped to 8 oz. on his loins, and by this operation he expressed himself much relieved; but he had got out of bed the same evening, probably to make water, and was seized, on rising from the night chair, with convulsions, and was dead before I could reach his bed. He died instantly, and without a groan.

POST-MORTEM EXAMINATION.

Both Kidneys were full of dark blood, so that the section of either presented a deep purple colour, much resembling that of the spleen. The papillæ of a dark crimson colour, and, when pressed, gave out a whitish turbid fluid. Some watery effusion into the meshes of the pia mater, and into the ventricles; but the viscera, in other respects, presented nothing remarkable, in fact the organs were, with the above exception, a perfect specimen of healthy structure.

This form of chocolate-coloured Kidney is the first stage of "Dr. Bright's Kidney," and of Dr. Christison's and others "granular degeneration" of this organ.

CASE VII.

OBSTRUCTION OF THE WHOLE SYSTEM OF FEATHERY OIL-TUBES FROM RHEUMATISM.

— S., aged 32, tailor. A pale face, white skin, and sickly countenance; pain in his loins, and slight rheumatic pains in his joints, shifting about; palpitation, occasionally very severe; a loud bellows sound attends the systole, heard over the whole chest before and behind; no pulmonary affection; cough, but no expectoration; sleeps ill; nausea, with or without food; sour or bitter taste in the mouth, like rancid butter, or as if he had taken onions; urine scanty, loaded with a brownish sediment, evidently blood; spec. grav. 1·013, acid and albuminous, copiously so.

Has had eight attacks of acute rheumatism. The first one when 15 years old, and then had pain in the chest and palpitation, which has remained more or less ever since. Has been in an hospital six times, once with ulcerated sore throat, once with hæmaturia and doughy dropsy, and four times with acute rheumatism. A very temperate man in his habits.

During his short career at this time, he had frequent calls to the water-closet, when he passed scanty and watery evacuations, and could rarely void his urine, separately, without an evacuation from the bowels; the one action called on the other; abdomen tympanitic. His sickness became more and more distressing and urgent, and the nauseous, rank smell of his breath increased. His head became attacked with severe pain, and intolerance of light, and a relapse of bloody urine came on ten days after his illness, for which he was, as formerly, cupped with relief to his loins. However, from this day to his death, he passed scarcely 2 oz. of urine in 24 hours; vomiting constantly; fluids, grass green in colour; pulse wiry, 84. On the morning of the 9th, a fortnight from his attack, he had a sudden convulsive struggle, and died instantly.

POST-MORTEM EXAMINATION, 24 HOURS.

Head.—Arachnoid slightly thickened over the cerebellum, otherwise all was healthy.

Thorax.—Pericardium universally adherent to the heart; cavities of the heart large; valves on both sides of the heart, rigid, but especially the aortic, which were puckered, and could ill perform their office, two of them being adherent; lungs healthy; liver congested with portal congestion.

Kidneys were larger than natural, but not much. I did not see

any fat about them. They were hardish, and universally, like a boiled turnip, with a few lines painted on them representing the tubular part. This portion of the organ was nearly obliterated. The whole mass felt hard and unctuous to the touch. Whatever urine was secreted came from the oil-tubes, just at the points of the cones. The papillæ, as well as every other part, were blocked, and presented one dense white mass.

In the right Kidney a vein was found, having a white coagulum, like a piece of pipe-clay, firm, and, when dried, quite brittle, like fibrine (congealed oil ?). The other Kidney, the left, was injected, but the injection did not run in either veins or arteries beyond the cones. It ran as well, however, in the former as in the latter set of vessels.

The blood of the body was fluid, except some slight coagula in the heart.

This case denotes the third and worst stage of diseased or obliterated oil-tubes and urinary ducts. I believe the constitution bears with, and suffers less from obstructed urinary ducts than from obstructed feathery oil-tubes. The scanty secretion here must have been, long since, wholly from the latter set of tubes.

CASE VIII.

DISEASED AND OBSTRUCTED OIL-TUBES, FOLLOWED BY EPILEPSY, DIMNESS OF VISION, LOSS OF MEMORY, AND DEAFNESS, &c.

T. B., aged 44, tailor. Lost the left leg at Trafalgar. A countenance of extreme distress and anguish, a pale or dirty yellow, or fawn-coloured skin, with very little hair on the arms, legs, and thighs; bitter rank taste in the mouth; severe headache in the forepart; slight deafness; confusion of intellect, and loss of memory; eyes dull and heavy; has fallen down during the last twelve months in four separate epileptic fits; had no warning, and rallied out of them, and was quite as well, as before them, in the space of 12 or 15 hours; shortness of breath and palpitation; pain around the liver, and tenderness on pressure over the Kidneys; urine acid, scanty, like stale beer, highly albuminous; spec. grav. 1·019; intense thirst. For two years past has had slight difficulty in passing his urine, and before, and ever since his first fit, one year ago, has passed it in a very small stream, or only by drops.

On the 25th he began passing his evacuations involuntarily, and seemed unconscious of what was going on around him. He had convulsive twitchings of the hands and arms, and laid on his back, moan-

ing and staring vacantly at the ceiling. He died in the course of this night.

POST-MORTEM EXAMINATION, 18 HOURS.

All the viscera were healthy, save a dilatation of the heart, with soft and flabby walls, and large cavities, slight emphysema of the lungs, and a conjested liver, portal, I think. Kidneys were imbedded in a due supply of fat, which was hard and nodular to the touch. The feathery oil-tubes were blocked up, and gave a white, mottled ground to the red vessels. In fact it was a perfect specimen of the first, or perhaps I ought to say, second stage of the impervious oil-tubes of the Kidney.

There was a stricture of the urethra.

This is one of a numerous class of cases that are constantly mistaken for epilepsy, arising from disease of the brain. I might enumerate many more such like instances of diseased Kidneys producing epileptic fits, in whom there was not the slightest suspicion of disease in any other organ than in the brain, and yet, on a post-mortem examination, the Kidneys, only, were the organs found to be in an advanced state of disease.

CASE IX.

THE SECOND STAGE OF OBLITERATED OIL-TUBES FROM RHEUMATIC GOUT.

— B., aged 46, laid up with the sixteenth attack of gout. His hands and legs, nodular at the joints, from gouty deposits; fingers locked, and standing out, unable to close them or the fist, and cannot crawl across the room from his general stiffness. The first attack begun at 34 years of age, and during the last twelve years of his life he has had sixteen attacks, more or less severe.

A few days after this illness he complained of dribbling away of urine, but though he did not speak of it as very troublesome, it is clear it was from some dulness of mind and feeling in him; that for a week from this period he was observed to be much altered in his manner, obstinate, morose, and fretful. He complained of headache and dimness of sight, and in a few days from the accession of these symptoms he had an epileptic fit, and this was followed by several others, more and more severe. He declares he never had such an attack in his life before. His urine diminished in quantity after the first fit, and was, throughout his illness, as pale as inf. quassiæ, and of the spec. grav. of 1·008, clear and acid. The bladder seemed distended, and a catheter was attempted

to be passed, but failed; even the smallest bougie could not pass, from a stricture in the membranous portion of the urethra. After several ineffectual attempts, it was introduced, and about a tea-cupful of urine drawn off, so that it now looked a case of genuine suppression. His fits recurred oftener, the contortions of his mouth were very horrid, and he died in a fit of epilepsy.

POST-MORTEM EXAMINATION.

HEAD.—The arachnoid slightly opaque; some clear fluid in the ventricles; no evidences of disease whatever in this organ.

CHEST.—Heart flabby; atheromatous or waxy deposits along the area of the large arteries; some emphysema of the lungs.

ABDOMEN.—The liver contained several greasy, putty-like, tenacious masses, which Mr. Everett, professor of chemistry, analysed, and found to consist of carbonate and phosphate of lime, and cholestrine.

The Kidneys were studded within and without with round, white, pea-like tubercles; no doubt they were the Malpighian bodies. The diseased surface of the gland did not admit any injection, and the other parts received it but very imperfectly. The ureter was very much dilated. The tubercular bodies were filled with soft, curdy, purulent matter, and the adjacent structure was white: the whole series of feathery oil-tubes were far advanced in disease, though not so far, but that they did, doubtless, drain off much fluid from the glandular animal oil.

APPENDIX II.

No. 1.—GALEN.

1. Motu proprio ad renes confluit?
2. Vel vacuum explet?
3. Vel ab expultrice venarum propellitur?
4. Vel ab attractrice renum virtute allicitur?

No. 2.—CARPI. "Commentaria in Mundinum."

"Et circa eas, (id est, papillas) vidi terminari tales venas parvas, portantes aquam urinalem ad lacunam porri uritidis."

No. 3.—Ant. Deusingius. "Anatomia Humana."

"Renes facultate insitâ separationem instituunt, serum superfluum cum salibus, et tartaro ad ureteres ablegant, sanguinemque depuratum (relictâ tamen parte quæ in nutrimentum cedat,) per venas reductorias ad cavam, et demum ad coloris nativi scaturiginem, cor scilicet, denuo amandant."

No. 4.—Aristotle. "De Partibus Animalium."

"Finis autem probæ concoctionis adeps et sevum existit; unde inferendum, renes sanguini concoquendo ac perficiendo inservire, non solum pro nutritione, et substantiæ propriæ conservatione; sed etiam ad redundantiam quandam, quæ in pinguedinem converti, et aliis partibus utilis esse potest.

"Hæc autem copia sanguinis optime concocti, aut in renibus producitur, aut ab aorta arteria eò deducitur."

No. 5.—Laurembergius.

"Venæ hæ serum, vel aliud quicquam emulgent; ac seu contrectando, seu exprimendo."

And again,

"Elices autem veteribus erant sulci aquarii, per quos aqua educebatur ex agris; dicti ab eliciendo. Sic per hæc vasa, ceu canales, elicitur ex corpore aquosum seri profluvium."

No. 6.—Vesalius.

"Renum nempe substantiam facultate sibi innata, ac propria ad justitiam temperie, formaque essentiali ex venis, ac arteriis per ipsius corpus diductis serosum illud recrementum excolare in sinum, (qui idem cum corpore membraneo est), qui urinario meatu excipitur."

No. 7.—Highmore.

"Vacua inter illa ostenduntur spatia (venarum ac arteriarum), quibus serum ex vasis per exsudationem exclusum in pelvi per illorum parenchyma, quod spatia illa inania replet, percolatur."

No. 8.—Bauhinus. "Theatr. Anatom."

"Usus renum est, serosum sanguinem attrahere per venas et arterias emulgentes, ut ita sanguis repurgetur."

No. 9.—Bartholinus. "Anatomia Reformata."

"Pars vero sanguinea, et partim laudabilis, remanet pro nutritione renum, partim per emulgentes venulas patulas in cavam redit ad cor."

No. 10.—John Jac. Harderus. "De Usu Viscerum."

"Munera honorabilia renum octo sunt.

"Honorabilius munus est renum, sanguinem arteriosum ac venosum parare.

"Pingue copiosum cur renibus prospectum, nisi elaborationis et concoctionis causâ?"

No. 11.—MALPIGHI. "Exercit. Anatom. de Renibus."

"Ut autem hæc facillimè innotescant, injiciendus est niger liquor spiritu vini commixtus per arteriam emulgentem, ita ut totus turgeat ren, et exterius denigretur ; nam nudis etiam oculis, ablata renum membrana, illico occurrunt bifurcatis hinc inde arteriis, appensæ nigro et ipsæ colore infectæ glandulæ ; et secto per longum eodem rene, inter vasorum urinæ fasciculos et innata interstitia etiam innumeras fere easdem observabis ; quæ sanguineis vasis atro liquore turgidis in speciosæ arboris formam productis, veluti poma appenduntur ; vulgata circumfertur in hujus confirmationem historia, in qua visebatur in rene lapillus, tot particulis constans quot in rene venularum erant ramuli, quarum particularum lapilli extremum velut caput marmoris rotundi, et candidi frustulum referebat, vel margaritæ majusculæ figuram et splendorem."

No. 12.

"Hæ igitur glandulæ in hac renum extima parte locatæ penè innumeræ sunt, et ut *probaliter censeo* congruunt urinæ vasis, quibus coalescit renum moles, quæ in singulis quibuscunque fasciculis, quorum ope in omnibus renibus expositæ minimæ illæ divisiones suboriuntur, quadragesimum excedunt numerum."

No. 13.

"Quoad figuram, ob exiguitatem et luciditatem qua maxime pollent, distincta circumscriptio non habetur; videntur tamen rotunda veluti piscium ova, et tum per arterias ater humor propellitur, denigrantur et circumcirca diceres habere vasorum extremas propagines, instar serpentium capreolorum incedentes, ut coronatæ quasi apparent, cum hac tamen conditione, ut præcipua pars, quæ arteriæ cum ramo appenditur, denigrescat, residuum verò proprium retineat colorem."

No. 14.—BELLINI. "De Structura Renum."

"Desinunt ad idem spatium tàm capillares venæ emulgentes, quàm renales ductus, quos diximus ; ambo enim hæc vasa ad extimam superficiem terminari, demonstratum est. Cum ergo sanguis extra arterias prodierit, duplicem vasorum ordinem offendit, venalem scilicet unum, renalem alterum. Cum ergo renales ductus, et venæ ad spatiolum illud terminentur, ubi sanguis sero permistus ab arteriis effluit, inveniatque serum siphunculos illos renales sibi proportianatos ; itemque sanguis venas sibi accommodatas obtineat, &c.

"Certoque certius apparebit, ab extima superficie, usque ad pelvis cavitatem, hasce fibras esse continuas."

No. 15.—SCHUMLANSKY.

"Quodlibet foraminulum, in papilla foveola conspicuum, continuatur in tubulum, unam aut sesquilineam et ultra brevem, crassiusculum, qui tunc in duos secedit truncillos, quasi minores, cylindricos tamen. Hi

rursus aliquam distantiam emensi bifurcantur in duos alios, qui vix aut ne vix quidquam de sua diametro perdunt, a vasis sanguiferis mirum quantum diversi et majores. Incedunt sic porro dichotomi cylindrici, recti, aut a recta non multum abludunt, et in via continuo sese duplicant, multiplicam, ad ipsam papillæ basin, per tenerrimam cellulosam telam inter se juncti. Nunc vero aucti et diametro vix recolliguntur in unum duosve fasciculos, a se mutuo et a vicinis per vascula rubra in toto suo ambitu separatos. Fasciculorum singuli subeunt tunc suum meatum, a plexu fornicis vasculoso efformatum; superato hoc, ductuli suo in fasciculo contenti, et secum nexus non amplius fiunt dichotomi, sed solitarii in eadem directione tendunt per corticis crassitiem, unde lateraliter divaricantur et serpentini cursu, multifariis gyris inter se contorti, absque ramis longissime vagantur. Serpentinus ductus singulus, a suo recto continuatus, non eidem insertus, lateraliter deflexus, eandem fere semper diametrum et albedinem servat."

No. 16.—Müller.

"Fines ductuum uriniferorum in corpora Malpighiana desinere, certissime falsa assertio est. Atque hæc modo obiter Schumlansky exposuit, cum cætera omnia singulis observationibus confirmaverit.

"Sed falsissima est opinio de connexu ullo quopiam inter corpora Malpighiana sanguifera et ductuum uriniferorum fines. Modo arteriis illa appenduntur, ductusque uriniferi liberis muticisque finibus desinunt."

No. 17[1].

"Postea Eisenhardt ipse vasa sua urinifera tanquam venosa declaravit; ductus uriniferos, ratus, ex iisdem originem ducere."

No. 18.—Doellinger.

"Ductus Bellianos scilicet non modo ex arteria, sed etiam ex venis oriri, magnopere dubium est; post renum per venas repletionem, contendit vir illustrissimus, optime observari posse, venas in reticulares maculas abire, ex quibus ductus uriniferi æque ac ex arteriarum glomerulis proveniant."

No. 19.—Müller.

"Persuasum igitur habeo, vasa sanguifera retiformia capillaria, quæ tubulos ductuum uriniferorum circumcirca ambiunt, huic arteriosum sanguinem suscipere, illinc venosum sanguinem venis amandare. Rarissime ex ductibus excretionis materia injecta etiam in vasa sanguifera transit. Nunquam materia injecta ex tubulis uriniferis in corpora Malpighiana transiit."

No. 20.—Müller.

"Quodsi particula renum, sciuri, ex superficie excisa, aqua per

[1] Meckel's Archives für Physiologie, t. 8. p. 218.

horas aliquot immersa, sæpius abluitur, tela cellularis conjunctiva inter ductuum gyros sensim aquâ resolvitur, quo ductus a se invicem discedunt, finesque mutici passim observantur. Hosce fines accuratissimè iterum iterumque examinavi. Plurimi indivisi, eadem diametro, qua ductus serpentini, cæteroquin mutici, vix ac ne vix quidem tumidi, cæcè terminabantur. Ductuum alii prope finem dichotomiam iniere, rami autem brevissimè æquales et ipsi cæcè desinere. Alii in duos ramos divisi, quorum alter iterum dividebatur, alter vero indivisus mutice desinebat. Quam latè singuli ductus pateant, priusquam post gyros multifarios cæcis desinant finibus, extricare non potui. Renum substantia in aqua relaxata, corpora Malpighiana et ipsa separatim distingui possunt, quo nullum cum ductibus uriniferis commercium illa inire evincitur."

No. 21.—Ferrein.

"Chacun de ces troncs, dans l'homme, ne s'ouvre pas immédiatement dans la papille, comme on l'avoit pensé, en prenant les faisceaux de ces vaisseaux blancs pour les tuyaux urineux, mais chaque ouverture de la papille répond à une espèce de cul de sac d'environ une ligne et demie de profondeur, dans lequel un nombre prodigieux de ces tuyaux va s'ouvrir."

No. 22.—Nuck. "De Renum Vasis Lymphaticis."

"Hinc non obscurè concluderem, arteriarum emulgentium extremitates, vasorum lymphaticorum constituere principia, quamvis præcisè locum, ubi arteriolæ faciem suam deponunt, et lymphatici vasis formam assumunt, notare non licuerit."

No. 23.—Morgagni. "Adversar. Anat."

"Nam arteriarum communicationem cum cellulis adiposis, in Sec. Adver. te non dissentiente, posuimus; cellularum autem ipsarum ibidem memoratum cum venis commercium Malpighius hic satis indicat, dum testatur, se in ranis, et in aliis animalibus, compressis præcipuè striis adiposis trunco venæ portæ adnatis, manifestas olei guttulas unà cum sanguine per eandem venam in hepatis cavum ferri vidisse. Cæterùm ejusmodi observationes ut reditum pinguedinis comprobant tum generatim in venas, tum speciatim in venam portæ, sic firmant illum omenti usum à Doct^{mo} Boerrhavio propositum, id est, ut sanguinem pro bilis separatione ad hepar tendentem multis oleosis particulis opportunissimè augeat. Quo usu admisso, animadverto, mesenterii usibus hunc quoque addi verisimiliter posse, videlicet ut sanguini per suas mesentericas venas ab intestinis ad hepar ascendenti, multas in transitu ex iis quibus copiosè ornatur, adiposis cellulis particulas oleosas ob eandem causam admisceat."

No. 24.—Morgagni. "De Usu Appendicularum crassorum Intestinorum."

"Nam primum quod pingues illas appendiculas crassis intestinis

tributas dicit, ut eandem quàm omentum, in lubricandis intestinis præbent; si quis animadvertat, omento anteriùs, mesenterio autem posteriùs sic intestina intercipi, ut maxima tamen crassorum pars inter illas duas pingues, lubricantesque membranas non excipiatur, is facilè intelliget, ob eam causam quam affert Glissonius, istas crassis appendiculas esse."

No. 25.—Gaultier de Claubry.

"Il paroît d'après tous ces détails, que toutes les fois que l'on enlève à des matières végétales ou animales, une portion de leur hydrogène, et que l'on rend le carbone surabondant; on place cette substance dans les circonstances convenable pour former, avec l'huile et l'acide sulphurique, une belle couleur rouge."

No. 26.—Aretæus. "De Renum acutis Affectibus."

"Ex renibus aliquando prorumpit plurimus confertim sanguis, perque multos dies continenter fluit; nemo tamen ex hac profusione moritur, sed ex inflammatione, quæ profusionem comitatur, si fortè sanguis supprimitur; atque ex suppressione, quam ingens inflammatio fecit, mors plerumque sequitur. Sed cùmque sanguinem profuderint, membra ipsius languida et resoluta fiunt, caput tamen levius et expeditius. At si in circuitu nihil effluat, caput dolet; oculi hebescunt et caligant, et circumrotantur; inde plurimos invadit EPILEPSIA: alii tumidi fiunt, obcæcatique, et hydropici: alii in melancholiam, aut PARALYSIN decidunt. Multis podagra in hydropem, aliis in asthma transiit; et ex his illi succedentibus non evitanda mors est [2]."

[1] "Crassus intestinus"—the colon, or large intestine.
[2] Joh. Wigan's Aretæus, fol. 1723. Oxon.

THE END.

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